Wealth mobility, familial ties and migration: Evidence from the Cape of Good Hope Panel

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Declaration

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Abstract

Mobility estimation is a means of quantifying how likely an individual is to improve their socio-economic status. Research concerning mobility has recently seen an upswing, mainly as a result of the rise in global socio-economic inequality. The less mobile a society is, the more persistent socio-economic status across time or generations will be. It would be easier for individuals and households in a highly mobile society to escape their relative levels of poverty.

African cliometric has traditionally been neglected. The deficiency in research output is the result of an absence of quality data with which to examine questions relating to issues such as wealth dynamics, mobility, inequality and migration. More recently, an increase in the availability of quality data sources has contributed to the surge in African economic history. South Africa, and the Cape Colony in particular, has enjoyed the greatest focus. The availability of a long-run longitudinal dataset allows this dissertation to approach research questions that have gone largely untouched for a historically underdeveloped society in a pre-industrial context. This dissertation provides an understanding of historical wealth mobility and behaviours relating to migration. It further contextualises South Africa's current high levels of land and wealth inequality.

The first subject of analysis in this dissertation is examining agricultural wealth mobility and how it influenced out-migration from two Cape Colony districts. The objective is to compare the ability of two different districts, most notably in terms of geographic characteristics and agricultural activities, to provide opportunities for socio-economic advancement, as well as settler migratory decisions in the absence of such opportunities. This dissertation estimates wealth mobility and survival models of out-migration from districts. Hazard rates generated from this survival analysis are included in the wealth mobility models to analyse how a lack of mobility related to migratory decisions. Households that were more likely to migrate, were generally those that exhibited less agricultural wealth mobility.

As a second theme for investigation, this dissertation explores out-migration further, but adopts a psychological approach. The effect of birth order and name inheritance is analysed as they relate to migration. Name inheritance is used as a proxy for a loyalty effects as opposed to a primogeniture effect in which earlier born sons inherited more. The aim is to establish which effect dominates. Psychology and loyalty effect is not significant in determining out-migration of settler sons. Instead agricultural wealth, which earlier born sons were better endowed with, was a greater determinant of out-migration.

The third question examined in this dissertation is how to properly control for lifecycle and period biases in intergenerational mobility estimation. A major problem in intergenerational mobility research is that varying macroeconomic contexts may present themselves in mobility estimates as lifecycle biases. This dissertation proposes a two-pronged approach to control for biased intergenerational mobility coefficients. The first approach is to estimate mobility within a cross-section and to control for lifecycle differences. The second approach estimates within age and controls for period biases. Comparable mobility estimates from both approaches confirm the significance of controlling for period and lifecycle biases.

Opsomming

Mobiliteitsberaming is ‘n manier om die waarnskynlikheid dat individue hulle sosioekonomiese status kan verbeter, te kwantifiseer. Navorsing aangaande mobiliteit het onlangs begin toeneem as gevolg van die toename in wêreldwye sosioekonomiese ongelykheid. Hoe minder mobiel ‘n gemeenskap is, hoe meer geneig is sosioekonomiese status om oor tyd of deur generasies oorgedra te word. Hoër vlakke van mobiliteit bepaal hoe inperkend ongelykheid vir individue of huishoudings is om moontlike armoede te ontsnap.

Geskiedkundige ekonomiese navorsing oor Afrika is tradisioneel afgeskeep. Die gebrek aan navorsingsuitsette vir Afrika ekonomiese geskiedenis is hoofsaaklik die gevolg van die gebrek aan gehalte, gedetaileerde data waarmee kwessies soos welvaartbeweeglikheid, mobiliteit, ongelykheid en migrasie ondersoek kan word. Gehalte databronne wat onlangs beskikbaar geraak het, het tot ‘n toename in geskiedkundige Afrika navorsing gelei. Suid-Afrika, en die Kaapkolonie spesifiek, ervaar tans die meeste fokus. Die baie lang-termyn lengtesnit datastel, stel herdie verhandeling in staat om navorsingsvrae aan te pak wat tot dus ver onaangeraak was vir ‘n historiese, onderontwikkelde gemeenskap in ‘n pre-industriële konteks. Die verhandeling bied begrip vir geskiedkundige weelvaartsbeweeglikheid en gedrag wat verband hou met migrasie. Dit plaas ook die bestaande hoë vlakke van grond en welvaartsongelykheid wat tans in Suid-Afrika heers in konteks.

Die eerste onderwerp wat hierdie verhandeling ondersoek is die mobiliteit van landbouwelvaart en hoe dit migrasie besluite vanuit twee disrikte van die Kaapkolonie beïnvloed. Die doelstelling is die vergelyking van hierdie twee uiteenlopende distrikte se vermoë om geleenthede vir sosio-ekonomiese verbetering te bied, en hoe ‘n gebrek aan sulke geleenthede setlaar migrasie-besluitneming beïnvloed het. Hierdie verhandeling beraam mobiliteit en, om die determinante van migrasie te bepaal, oorlewingsmodelle. Gevaarkoerse wat uit hierdie oorlewingsmodelle gegenereer word, word dan in die welvaartsmobiliteit modelle ingesluit om die verhouding tussen mobiliteit en migrasie te ondersoek. Huishoudings wat meer geneig was om te migreer was geneig om minder mobiel te wees in terme van hulle landbouwelvaart.

As die tweede tema, ondersoek hierdie verhandeling migrasie verder, maar met ‘n psigologiese benadering. Geboortevolgorde en naam erfenis se invloede op migrasiebesluite word verken. In hierdie verhandeling word naam erfenis gebruik as ‘n plaasvervanger vir lojaliteit van seuns teenoor hulle ouers, in teenstelling met ‘n eersgeboortereg wat tot gevolg het dat seuns wat vroeër gebore is, meer geërf het. Die doel is om vas te stel watter een van hierdie twee gevolge

dominant was. Sielkunde en ‘n lojaliteitseffek is onbeduidend in die migrasie besluite van setlaarseuns. Landbouwelvaart, waarin vroeër gebore seuns beter bedeeld was, was ‘n belangriker bepaler van migrasie.

Die derde vraag wat in hierdie verhandeling beantwoord word, is hoe om effektief vir die effek van lewensiklus en tydperk verskille te beheer in intergenerasie-mobiliteitsberaming. ‘n Groot probleem is verskillende makro-ekonomiese omstandighede wat hulself as lewensiklus verskille openbaar in intergenerasie-welvaartsmobiliteitberaming. Hierdie verhandeling stel ‘n tweeledige benadering voor om vir sydige intergenerasie-mobiliteitskoëffisiënte te beheer. Die eerste benadering behels om mobiliteit binne die deursnit-jaar te beraam en om lewensiklus verskille te beheer. Die tweede benadering beraam intergenerasie-mobiliteit binne die ouderdomsnit en kontroleer vir tydperk vooroordele. Vergelykbare beramings vir beide benaderings bevestig die belangrikheid om vir periodiese en lewensiklus sydighede te beheer.

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Naturally, the brunt of the support came from my supervisor Dieter von Fintel and co-supervisor Johan Fourie. At the end of 2016 it was Johan that presented me with the opportunity to undertake this long, challenging, yet exciting journey. Without him this dissertation would not have become a reality. The trust he and Dieter had in me at the very beginning, is what made this dissertation possible. I was introduced to historiographic research by Johan and I never looked back. The opportunity opened a whole new world for me regarding the content of the subject matter, and it afforded me the chance of working with a brand new data source and to explore questions that have not been open to analysis before. In this regard, Dieter played a major role in guiding me in my decisions regarding which empirical strategies to employ to answer the questions which the unique and fresh dataset cultivated. He introduced me to techniques and ways of thinking that I would have lacked otherwise. For this I will be forever grateful to him. His unyielding patience throughout the completion of this dissertation is also a virtue worth aspiring to. In the process of growing accustomed and familiar with new methodologies, Dieter was a steadfast pillar of support whenever I became overwhelmed with the mammoth scope of this undertaking.

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certain problems that I might have faced. I would, therefore, also like to thank my fellow GEM scholarship holders for their attendance of my presentations concerning the content of this dissertation, as well as their valuable inputs.

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Certain aspects of this dissertation would have been much more challenging to address had it not been for the various individuals I have communicated with over the last three years – both via email and in person. Your input was most valuable. It was also my privilege to have presented some of this dissertation's chapters at conferences – both local and international. The African Economic History Network Conference (Stellenbosch 2017 and 2018) and the German Congress for Economic and Social History (Regensburg 2019) served as treasured learning experiences and they were a vital part of the successful completion and refinement of this dissertation. In this regard it is crucial that I thank Johan as head of LEAP, and Professor Andrie Schoombee, head of Stellenbosch University's economics department, for their willingness to finance my trip to Germany to take part in the conference.

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I take complete and full responsibility for any shortcomings or errors that remain present in this dissertation.

Stellenbosch, March 2020.

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List of Abbreviations

HHI Herfindahl-Hirschman Index

IGE Intergenerational elasticity

PCA Principal Component Analysis

SAF South African Families register

SES Socioeconomics status

VOC Vereenigde Oost-Indische Compagnie (Dutch East India Company)

Chapter 1

1 Introduction

1.1 Research motivation

While there is research concerning inequality and living standards in the pre-industrial, historically underdeveloped Cape Colony (Fourie and von Fintel, 2010a; Fourie and von Fintel, 2010b; Fourie, 2011; Fourie and von Fintel, 2011; Fourie, 2013), wealth dynamics and social mobility remains mostly unexplored by empirical research – Cilliers and Green (2018) notwithstanding. No research exists that examine how entrenched inequality was, the response of settlers who failed to realise opportunities for socioeconomic advancement and potential issues when estimating the magnitude of such opportunities if they were indeed present. Compounding this issue is the fact that research examining wealth dynamics in a pre-industrial setting mainly concern historically developed economies.

It is necessary that topics on wealth dynamics receive adequate focus in order to establish, for instance, potential links between the likelihood of migrating and the extent of socioeconomic opportunities at the destination and originating economies – particularly in agriculture intensive frontier societies. The unique context in which this dissertation is set allows for determining the degree of motivation required for migration from an economy where resources and opportunities for socioeconomic advancement were limited. Such research also lends perspective to the experience of migrants in the destination economy as far as wealth accumulation is concerned. It further provides answers to the role that a frontier economy plays in absorbing such migration and the behaviour of this frontier economy once it becomes saturated with migrants and opportunities for socioeconomic advancement become depleted – especially for those with the least amount of resources at their disposal.

Consequently, this dissertation additionally informs on first-mover advantage, which does not necessarily only refer to geographic movements, but being among the first to move into a particular industry. In estimating wealth mobility, it enables the researcher to quantify the extent of this first-mover advantage and the amount of skills or knowledge necessary for second-movers to yield economic successes relative to first-movers. Analysing these issues in a pre-industrial, historically underdeveloped setting where resources were limited and inequality pervasive informs of the ease or difficulty with which inhabitants of historically

underdeveloped, agriculture intensive economies may improve their socioeconomic status (SES).

Among the research examining mobility in historically developed economies is the work of Maas and Van Leeuwen (2002), and Dribe and Helgertz (2016) that analyse Sweden's social mobility over the course of the nineteenth century, research by Knigge, Maas, van Leeuwen and Mandemakers (2014) that examines nineteenth century Netherlands, and several others.[1] The lack of research for historically underdeveloped societies is problematic given that the study of income and wealth mobility give economic historians a better conception of the likelihood of socioeconomic advancement and level of economic opportunity that prevailed in a pre-industrial context in these societies. In a country such as South Africa that is plagued with inequality and poverty, it becomes crucial to establish these issues' historical geneses. Understanding how unequal income or wealth was distributed and how entrenched inequality was, provide insight into the long-term trajectory of income or wealth distributions. It further lends perspective on the extent of the potential inertia presiding over socioeconomic status in unequal societies. The information garnered from analysing wealth dynamics can aid in policy formation concerning wealth distribution and inequality – particularly given the oft times heated debates in South Africa concerning agricultural land ownership and reform. This is of particular importance to establish, since evidence exists of a strong negative relationship existing between a country's level of inequality and its social mobility (Corak, 2013).

There has been a consistent strand of literature suggesting that in the case of developed countries there is persistence across time and space in terms of selected measures of socioeconomic status (Solon, 1992; Björklund and Jäntti, 2000; Jäntti and Jenkins, 2013, Dribe and Helgertz, 2016). This persistency in mobility suggest that there is not much opportunity for socioeconomic advancement and that inequality is entrenched. International historiography examining mobility and migration tends to suggest greater economic opportunity is present at agricultural frontiers, however (Sewastynowicz, 1986; Gregson, 1996; Hall and Ruggles, 2004; Stewart, 2005). In particular, for the case of Costa Rica, Sewastynowicz (1986) suggests that while the frontier may not necessarily be an unlimited source of economic opportunity, frontier

[1] Van Bavel, Moreels, Van de Putte and Matthijs (2011) examine social mobility in nineteenth century Belgium, Bourdieu. Ferrie and Kesztenbaum (2009) compare and contrast social mobility in the nineteenth and twentieth century France and United States. Ferrie (2005) estimates mobility in the United States since the nineteenth century, de Sève and Bouchard (1998) explores long-term mobility in nineteenth and twentieth century Canada, while Van Leeuwen and Maas (1997) calculate the extent of social mobility in the nineteenth and twentieth century Netherlands.

migrants experience favourable conditions for socioeconomic advancement. This finding is transferable to other frontier regions as well. For the case of modern Bangladesh, for example, Joarder and Hasanuzzaman (2008) suggest an inverse relationship between costs of migrating to the frontier and likelihood of doing so. This finding implies that migrants are only likely to migrate to the frontier if returns from doing so outweigh the associated costs.

With the greater opportunity for socioeconomic advancement on the agricultural frontier, there is generally more equality there as well. Di Matteo (2012) reports that while inequality in nineteenth century Canada pre-First World War was substantial, it was far less pronounced on the frontier. Canadian industrialisation inevitably led to greater levels of wealth inequality. Migration toward the agricultural frontier mitigated this to an extent. The major differences between the urban and frontier region was that the latter was characterised by greater dispersal of land ownership, generally lower levels of wealth and greater farm employment. In examining the late nineteenth century American Midwest frontier, Gregson (1996) reports that early settlers on the agricultural frontier reaped the benefits as the population on the frontier grew. These first-mover advantages could potentially have been an added incentive for settlers to migrate earlier, particularly if their opportunities for socioeconomic advancement grew stagnant in the originating economy. Earlier settlers had more time in which to grow accustomed to the different soil and market conditions, placing them ahead of second-movers.

Those individuals that elected to migrate early on to the frontier in the mid-nineteenth century United States were more likely to have been poor and landless (Stewart, 2005). Frontier migrants are likely those individuals that found it difficult to be successful in the established regions of the larger economy. Indeed, those individuals that stand to gain the most from migrating to the frontier would have been the most likely to move first (Stewart, 2009).

In a modern context for a developing economy, Murphy, Bilsborrow and Pichon (1997) emphasise the divergent wealth outcomes of migrants on the Ecuadorian Amazonian frontier. It was prevalent for some households on the frontier to be better off relative to others. Wealthier frontier families tended to be larger, own more land, have access to land that is more fertile and so forth. This finding points toward economic opportunity being present on the frontier, but that the same benefits do not necessarily accrue equitably to everyone migrating there. Inevitably, with the passage time, some households would become more prosperous relative to others. Apart from the varying outcomes of migrants residing on the frontier, migration to the Amazonian frontier from the more established regions of the economy took place for a myriad

of different reasons (Flavio, Carr and Bilsborrow (2009). Personal characteristics, human capital, lifecycles, networks and access to resources and infrastructure are all potential determinants for migration to the Amazon frontier.

For historical wealth, dynamics research specifically, Van Leeuwen and Maas (2010) note that researchers are limited by access to historical data on wealth and income. Quality sources of data appropriate for analysing societal social stratification are largely available for the United States and some countries in Europe. Comparable types of data are not generally available for historically underdeveloped countries such as South Africa. Van Leeuwen, Maas, Rébaudo and Pélissier (2015) argues, however, that regardless of the evolution in historical wealth dynamism research, data limitations remain a significant problem that inhibits analyses concerning social stratification and inequality in a pre-industrial context. This dissertation is specifically concerned with analysing wealth mobility and evolution of inequality over a long period, explore migratory patterns, and grant attention to methodological issues in intergenerational mobility estimation for the case of the Cape Colony from 1775 to 1844. An underlying objective, apart from those explicitly stipulated later on, is to contribute to the burgeoning research on Africa's economic history.

Africa's economic history is a relatively young field of study. Hopkins (2009) notes that the subject only emerged in the 1960s after which it experienced a dearth in research output – at least until more recently. From the 1980s onward, interest in the field declined significantly. A major impediment for research has been the lack of quality, historical data containing information on historical income or wealth on the micro or individual level. The field, nevertheless, remains crucial in forging an improved understanding of the reason for issues such as historically high levels of inequality in Africa. This dissertation, with a focus on the eighteenth and nineteenth centuries, examines inequality, wealth mobility, and migratory patterns among European settlers in the Cape Colony. It seeks greater comprehension of the potential engendering role that Colonisation played in cultivating the underdevelopment and unequal wealth distribution observed in South Africa today. By investigating the origins of inequality and wealth distributions, economic historians contextualise current developmental issues that face historically underdeveloped societies.

Among this research relating to African economic history, for example, is Acemoglu, Johnson and Robinson (2002) that examine the historical reasons behind the relative differences in various African countries' income distributions. They find that institutions established by

European colonists are responsible for the reversal of fortune many African countries face. Acemoglu and Robinson (2010) is another study that puts institutions not favouring saving and investment as genesis for Africa's poverty. Austin (2008) puts forward, factor endowment perspectives (with caveats) in explaining Africa's relatively low levels of development. An overabundance of fertile land and scarce labour inputs characterised pre-industrial Africa, with the natural environment constraining surplus land exploitation. Fenske (2012) offers more perspective on the land supplies' role in shaping institutions in Egbaland, Nigeria. Prior to 1914, the region was characterised with poorly defined land rights, the use of forced labour and using labour to secure loans. Changing supplies of land, labour and capital influenced these institutions. With an early period noted for its land scarcity, a market came to be for the most valuable tracts of land. Those who could acquire this land used slaves as labour input with greater credit facilities rolled out following the introduction of tree crops.

The significance of examining African economic history in understanding the continent's development trajectory, therefore, cultivated renewed research interest in the subject. In recent years research on South Africa, and more specifically the Cape Colony, proliferated. Indeed, Austin and Broadberry (2014) describe the renewed research interest in African economic history as a 'renaissance'. The so-called 'data revolution' that the African continent is currently experiencing is partly responsible for this 'renaissance' (Fourie, 2016). Detailed micro-level economic data for the Cape Colony has been the main driving force behind this empirical ascendance in South Africa specifically. Fourie (2014) notes that records kept by the Dutch East India Company (hereafter the VOC) over centuries, are providing economic historians with quality data to analyse the economies of historically underdeveloped, pre-industrial societies. Digitised versions of the official tax censuses or the *opgaafrollen*, allow for the exploration of various, hitherto unanswered, questions concerning settler wealth distribution and inequality in pre-industrial South Africa (Fourie and Green, 2018). The long period, geographic coverage, and more importantly, the longitudinal nature of the expanded dataset, permits this dissertation to examine questions that have been beyond the reach of South African historiographers until now. It has now become possible to examine issues relating to wealth dynamics, migration and methodology in the context of a historically underdeveloped, pre-industrial society. The need to examine South African economic history as a precursor to understanding its historical levels of underdevelopment, access to superior computing power, and unique data sources such as the *opgaafrollen*, have all been contributing factors in driving the ascendance in South African economic history research (Fourie, 2018). Similarly, Greif

(1997) attributes the recent resurgence in economic history to greater computing power and new, large datasets, among other contributing factors.

The dataset allows for a district-level comparison of inequality and wealth mobility in the Cape. The Stellenbosch district, which was located close to the south-western coast of the Colony, had been longer established in this dissertation's period of observation. The major economic activity in this district was viticulture, with the preferred labour input being slaveholdings. In this dissertation's historical context, enslaved peoples were an important productive asset (Guelke and Shell, 1983; Fourie, 2011; Martins, 2019). The interior district of Graaff Reinet, in contrast, was younger with a mountainous and dry landscape that was not suited for expansive crop farming and viticulture. Settlers in this region mainly employed Khoi or household labour in agricultural activities. Given these varying conditions in geographies within the Colony, the Cape was characterised by high levels of geographic dynamism (Fourie, 2013). Migration was frequent and many settlers who were once located closer to the coast in more established regions, migrated inward to settle in the interior and pursue livestock farming.

Neumark (1957) and Guelke's (1976) two early pieces of historiography explain this movement towards the interior and agricultural frontier. The former attributes migration to a search for abnormal agricultural returns in excess of that which could be realised in the more established areas. The latter, in contrast, described it as being an act of desperation. Settlers who were unsuccessful in the more established districts required a place of economic refuge. Livestock farming practised in Graaff Reinet provided such refuge, given the low entry costs to a livestock farming start-up. To the author's knowledge, no studies empirically examine the relationship between wealth mobility and out-migration from a society – particularly in a historically underdeveloped, pre-industrial setting. It is, therefore, not possible to establish the economic motivation for the high levels of migration present in the agricultural economy of the Cape Colony as suggested to have been the case by Fourie (2013).

Apart from having access to these recently expanded, digitised tax records, this dissertation also has genealogical records at its disposal. This dataset allows for the exploration of demography's role in socioeconomic outcomes once linked to the *opgaafrollen*. Research focusing on demographics of the Colonial Cape, can mainly be restricted to Cilliers and Fourie (2013) and Cilliers (2016). Research examining the relationship between childhood household circumstances and adult economic outcomes in a pre-industrial, historically underdeveloped

setting has enjoyed little attention.[2] This is even more prevalent for African cliometric research in general and South African history in particular. The relevance of studying family dynamics and its effects on adult economic outcomes is not only rooted in how families may have preserved their wealth, but also how it explained historical geographic dispersal of family units. This dissertation therefore informs of the underlying reasons why communities came to be and whether modern theories relating to certain subfields within psychology are applicable in a historical context.

The Cape Colony is characterised by a vibrant frontier expansion towards the interior of South Africa as noted in Neumark (1957), Guelke (1976), Shell (2005) and Fourie (2013). These studies document the economic and legal reasons for this expansion. The reasons for out-migration from various districts of the Colony has yet to receive empirical consideration, however. Prevailing research has not yet ruled out whether or not these dispersal patterns may have a psychological dimension induced by factors such as siblingships, birth order or naming conventions. The varying social conditions these aforementioned factors cultivate within the settler household unit, would shape personalities and give way to divergent adult economic outcomes (Taubman & Behrman, 1986; Majoribanks, 1989; Draper & Hames, 1999; Milne & Judge, 2009; Sulloway, 2010; Breining, *et al.*, 2020). Other studies, however, suggest no significant relationship between birth order and adult outcomes (Guastello and Guastello, 2002; Rohrer, Egloff and Schmukle, 2015; Rohrer, Egloff and Schmukle, 2017). Evidence is therefore not conclusive on the role that birth order and parental household characteristics play in determining adult socioeconomic outcomes – particularly not in a pre-industrial, historically underdeveloped context.

An issue when analysing wealth and income mobility is that it fails to control lifecycle or period biases that would result in biased mobility estimates. With variances in lifecycle patterns also being present, employing proper methodology in examining mobility is imperative. Favre (2019), in calculating mobility from historical data for Switzerland, argues for the importance of controlling for lifecycle patterns. The social status of an individual at one point in their lifecycle is not representative of SES. Jenkins (1987), Grawe (2006) and Nybom and Stuhler (2016) reach similar conclusions concerning lifecycle effects yielding biased mobility estimates. This dissertation shows that there is an alternative, hitherto unutilised, strategy of dealing with these biases, which controls for temporal changes in the economic environment

[2] Research that examine demography, sociology and adult economic outcome, mainly exists for historically developed countries (Faurie, Russell and Lummaa, 2009; Nitsch, Lummaa and Faurie, 2016).

and variations in lifecycle patterns. The seven-decade-long historical, longitudinal dataset used in this dissertation permits the examination of this question. The case of the Cape Colony is also a useful case to conduct this analysis. Transitory shocks such as the change to slave import legislation in 1807 would have significantly influenced settler farmers' lifecycles in the primitive, largely slave-driven economy.

Earlier qualitative research mischaracterised the Colony to be underdeveloped and devoid of opportunities to achieve high levels of wealth and prosperity. Newer research suggested these original conjectures to be only half-truths. The Cape did provide some opportunity for socioeconomic advancement and wealth gains. Equipped with the expanded, digitised versions of the official Cape tax records, the *opgaafrollen*, the dissertation firstly determines how entrenched inequality was and how likely wealth mobility was when growth-stifling institutions beleaguered a historically underdeveloped society.[3] It furthermore explores the influence of this wealth mobility on migratory patterns in the Cape. This dissertation also investigates migration. It rules out personality differences induced by birth order or naming conventions, as a determinant of geographic settler dispersion. Finally, given the various regime changes, it analyses the effects of lifecycle and period biases on intergenerational mobility estimation.

This dissertation consequently sets out to provide answers to the following specific research questions: How pervasive was agricultural wealth inequality in the Cape Colony? Did entrenched wealth inequality in the Colony induce out-migration? Were there other explanations, associated with certain subfields of psychology, for out-migration from apart from wealth? Did the continuous subdivision of wealth and other associated regime changes result in lifecycle and period biases when estimating intergenerational mobility?

1.2 Historical context of the Cape Colony

Before empirically analysing the aforementioned questions, it is firstly necessary to contextualise the historical setting in which the research takes place. In mobility research, it is firstly appropriate to discuss societal customs as far as inheritance laws are concerned. This affords an understanding of the general practices that governed transmittance of material wealth from one generation to the next. In the Cape Colony, the Roman-Dutch law of

[3] Extensive agriculture in which abundant areas of land was substituted for capital and a dependence on slave labour above wage labour, contributed to short-run increases in productivity but it did not translate into long-term prosperity (Fourie, 2013).

inheritance prevailed deep into the nineteenth century. According to this law, from the nineteenth century onward, the widow of a deceased settler inherited two-thirds of the estate. The remaining third, in contrast, was equally divided among the settler children on intestacy, or in the case of a will, settler children could claim their bequeathed portions. Ross (1993:141) confirms the practice of allowing offspring to claim their willed portions of their deceased parents' estate. The law only became applicable once settlement with adult offspring was reached. Children could claim at least a sixth of the estate's total value in the presence of a will and half (before the turn of the nineteenth century) of the value if a will was absent. In the period of observation, in the absence of a will stating otherwise, only a third of the total estate value was divided among offspring. According to De Kock (1924:460), this arrangement resulted in the subdivision of land into tracts of decreasing size. Both Ross (1993:141) and Dooling (2005) substantiate this institution of estate subdivision. Later generations of offspring witnessed such wealth subdivisions frequently. Coupling the large size of settler families with these inheritance practices implied an inevitable dissipation of agricultural wealth at the death of the progenitor. With a settler offspring of well-endowed parents able to acquire at least some windfalls of wealth, the question naturally arises how mobile the Cape society was in terms of agricultural wealth distribution.

It is necessary to examine the history of the Cape Colony closely to be able to provide answers to the major research questions posed at the end of the previous section. Simply assuming entrenched inequality because of the Roman-Dutch law of inheritance would be a myopic view of the process of wealth accumulation and the patterns of migration it yielded. This section provides an overview of the historical context in which this dissertation's analysis takes place.

1.2.1 Establishment of the Colony

The Cape first came under occupation of the Dutch in April of 1652 after the VOC assigned three ships for expedition to the Cape under the command of Jan van Riebeeck. It was the initial intention of the VOC only to establish a refreshment station at the Cape. There were no aims for colonisation. With the arrival of the first group of settlers aboard three Dutch ships, Jan van Riebeeck was tasked with erecting a fort, establishing a garden, and cultivating friendly relations with the native Khoi pastoralists from whom to trade cattle. The halfway house or refreshment station had the main objective of provisioning passing ships en route to India with fresh produce, meat, water and treating the sick. The motivation behind the VOC for establishing a refreshment station at the Cape was, therefore, purely for practical and economic reasons. There were no underlying political or religious ambitions. The initial settlers that

arrived from Europe were either in the civil or military employment of the Company, and included a few other necessary personnel like artisans and labourers (De Kock, 1924:7). Neumark (1957:7) notes that even though the initial intention was not to establish the Cape provision station as anything else, challenging conditions at the Cape soon required the formation of a settlement and ultimately expansion into a colony.

Five years into the occupation of the VOC, a significant amendment was made to their *modus operandi* after failure of the confined farming operations. Authorities in Europe formulated plans to colonise the Cape and to settle released VOC employees (*free burghers*) on the land surrounding the fort to pursue agricultural activities and expand the garrison's output. These plans were formulated to strengthen the position of the Company at the Cape, and perhaps more importantly, minimise expenditures. The year 1657 was marked as the year during which the VOC, probably unknowingly, initiated colonisation of the Cape by releasing nine Company employees. These *free burghers* were granted tracts of land on which to strictly cultivate wheat, rye, barley, oats and rice.[4] The Company also went so far as to exempt these fledgling farmers from taxes for twelve years (De Kock, 1924:12).

The output produced by the *free burghers* was subject to VOC-enacted price controls and the VOC barred them from trading with the native pastoralists. The Company upheld strict rules and regulations with little freedom for the fledgling settlement, which came to characterise the greater portion of the Colony's history. According to De Kiewiet (1941:5), the VOC worked tirelessly to maintain the *status quo* in the colony – from safeguarding its tobacco monopoly to preventing the growing *free burgher* population from moving beyond the set Colony limits. Since liberty was hard to come by in such close proximity to the fort the *free burghers* increasingly endeavoured to seek it in the interior of South Africa. According to the qualitative accounts of De Kock (1924:28), development at the Cape was inhibited by VOC-imposed restrictions on trade and industry, a lack of adequate transportation infrastructure, the land tenure system in the interior of the Colony and insufficient capital among settlers to acquire new land or productive assets, or investing in upgrading and developing existing land.[5]

1.2.2 Land ownership and property rights

The VOC initially granted land on freehold tenure to *free burghers*. This land tenure system entailed that after a period of three years, holders of the agreement received all land cultivated

[4] The VOC initially barred f*ree burgher* farmers from producing tobacco, for which the VOC had a monopoly.
[5] Swanepoel and Fourie (2018) dispute the inhibiting effects of the loan system of land tenure.

or transformed in full and free. Given the primitive farming methods followed by these early farmers, the result was that the farms were relatively small for a young settlement with abundant fertile land. While the *free burgher* farmers cultivated crops, they initially traded livestock from the native pastoral populations. These means of acquiring meat was laden with uncertainty. The VOC consequently motivated farmers to undertake livestock farming over and above crops. This additional task necessitated the issue of greater tracts of land to accommodate livestock. The authorities consequently issued grazing pastures to prospective pastoralists or graziers on 'loan'.

Loan tenure involved the VOC leasing land to a farmer for a year after which the agreement was subject to renewal. It remained the prerogative of the Company to revoke the agreement at expiration. Hence, theoretically, loan agreements did not offer farmers in the Colony considerable levels of certainty or security. This arrangement therefore could have had negative effects on a settler household's willingness to develop or improve the land. Swanepoel and Fourie (2018) argue, however, that *de facto* property rights for land held under loan were no less secure than the *de facto* property rights under freehold tenure, even though *de jure* property rights might have been considerably different. These findings suggest no significant difference in the usage of land in the Cape in debt transactions, regardless of tenure. Settlers who pursued livestock farming on land held under loan were at least as able as viticulturists that occupied freehold or perpetual quitrent land, to obtain finance for wealth generation. The type of land ownership is, therefore, not necessarily a major determinant of wealth mobility – even though the nature of the particular operations, viticulture or livestock farming, practised on that land may have been. This dissertation sets out to establish the likely differences in the wealth generating potential between these different major agricultural practices.

Loan tenure, according to Botha (1919) was essentially contractual permission granted by the VOC to the occupier of a tract of land to let his cattle graze there. The stipulations of the agreement entailed the payment of a monetary rental value or tithe, as well as annual renewal of the agreement.[6] De Kock (1924:32) notes that the legal insecurity of the loan tenure system and for its tendency to permit livestock to move around resulted in livestock farmers migrating frequently.[7] In later years, this contributed to a mass movement of settlers toward the frontier

[6] Tithes are a portion of the agricultural output cultivated on land held under loan, because the Company were allowed to continue usage of that land.
[7] It should be noted that loan land tenure was not as insecure as one would expect from literal interpretation of the terms of these agreements. This is due to lax enforcement of such agreements and loan land only becoming a major aspect of the land tenure system after decades of non-interference in land ownership by the VOC.

of the Colony. More and more unsuccessful crop or wine farmers or those disgruntled with the governing authority opted to pursue livestock farming on the agricultural frontier. The major objective of the VOC in issuing land on loan was to support production output (Dye and La Croix, 2018). It was a cost-effective strategy to rapidly inhabit large tracts of land and expand Dutch pastoral activities.

Loan-lease remained the most dominant form of land tenure in the Cape under the administration of the VOC.[8] This agreement continued into the early years of British administration until 1813.[9] In 1813, Governor John Cradock introduced a more permanent arrangement with respect to land tenure. This arrangement allowed holders of loan agreements to apply for formal conversion of their loans to what was termed 'perpetual quitrent agreements'. Perpetual quitrents granted holders full title to the land they occupied, which allowed them to hereditarily transfer the land – in part or wholly – or do with the land and buildings located on it how they saw fit. The government was hopeful that this tenure would encourage farmers to persist for longer on particular tracts of land, upgrade and develop the land, and in the process expand the agricultural capacity of the land and the whole Colony. The British government believed that this would deter settlers from moving even further into the interior of South Africa. Many settlers were enthusiastic to convert land held in loan into perpetual quitrents, however. They were simply accustomed to the *status quo* and it suited their needs to be able to move around whenever there was a need for new grazing pastures or water sources. They were unfazed by the improved *de jure* property rights, given that the *de facto* property rights among different land tenures were comparable.

During earlier times, when there was still an overabundance of quality, fertile land at relatively cheap prices, sons – upon the death of their father – moved on to occupy vacant tracts of land. Soon, however, the land that could easily be transformed for agricultural and pastoral ventures became in short supply resulting in inflated land prices. Cilliers and Green (2018) report that this happened on the agricultural frontier of the Colony upon its closure. With an influx of migrants, land sizes shrunk and prices inflated.

Nevertheless, it still offered livestock farmers the means of easily moving about in search of superior water sources and pastures for the livestock. Swanepoel and Fourie (2018) confirm as much.

[8] According to De Kock (1924:32), loan lease land consisted of five sixths of all land occupied in the Colony.

[9] The British crown occupied the Cape in 1798 before a short stint of the Cape being under Batavian rule from 1803 until 1806, before the British took over administrative powers again.

1.2.3 The Colonial economy and settler wealth

The earlier historiography concerning the Cape Colony's economy paints a negative picture. De Kock (1924:28) notes that there was a Colony-wide suppression of agricultural production given the VOC's foreign trade restrictions. Such restrictions did not allow settlers a market for their surplus produce. These restrictions had a negative effect on the purchasing power of settlers at the Cape. Moreover, price controls on produce sold within the Colony was a further inhibitor to local production. The lack of thriving industries meant there was no market to absorb excess produce. These conditions lead to settler farming operations becoming subsistence-type entities. According to De Kock (1924), the restrictive policies of the VOC resulted in a diminished agricultural and pastoral industry in the Cape – the two major sectors of the fledgling Cape economy. The outcome of a shrinking agricultural industry was that production output was mediocre, consumer power was limited, widespread conservatism among farmers prevailed, and the colony was characterised by general backwardness and subsistence (Trapido, 1990).

Recent empirical research, however, suggests that early historiography greatly underestimated economic opportunity. Although high levels of inequality characterised the pre-nineteenth century Cape (Fourie and von Fintel, 2011), there was still substantial opportunities for socioeconomic advancement throughout the course of the eighteenth century (Du Plessis and Du Plessis, 2012; Fourie, 2013; Du Plessis, Jansen and von Fintel, 2015).

With the restrictive and authoritarian policies enforced by the VOC at the Cape, it is necessary to shift focus toward the period of importance in this dissertation. The year 1795 marked the year that the British Empire conquered and occupied the Cape Colony until 1803. The British maintained a large naval presence during this time. With this military occupation, came significant expenditures by the authorities. De Kock (1924:85) notes that the British spent at least £1,500,000 at the Cape from 1795 until 1803. This cash injection translated into high levels of wealth accruing to settlers located in the immediate vicinity of what is modern-day Cape Town. Despite assurances to the contrary, however, the British pursued mercantilist style policies during this first occupation. The policies entailed supplying Britain with primary goods in the form of raw material and produce (Cilliers and Fourie, 2018). Although the authorities introduced several trade and navigation restrictions, they granted Colonists more commercial opportunities than under the strict VOC policies (De Kock, 1924:86). One significant improvement from VOC days was the sanction of free internal trade. Settlers located on the frontier of the Colony faced a tumultuous time during this first British occupation. Livestock

farmers faced frequent raids and imprudent wheat exports threatened famine. The pressing hunger, trouble in the frontier regions and reneging on several promises laid the foundation for a general feeling of dissatisfaction among settlers with the British authorities. This dissertation, therefore, expects that settlers would not need much incentive to migrate from a district – especially in the more established regions – in search of better economic prospects elsewhere.

In 1803 the Cape came under the rule of the Batavian Republic. The change in government bore witness to the introduction of several reforms. Some of these reforms included the institution of a commission to promote agricultural and livestock farming output and an abandonment of trade restrictions. These reforms resulted in significant improvements to the settler economy (De Kock, 1924:86).

With the Cape being deemed a point of strategic military importance by the British Empire in their conflict with France, they recaptured the Cape from the Batavian Republic in 1806. Notwithstanding this change in government, many of the more liberal policies introduced by the Batavian Republic was upheld by the British. Among these policies were farmers being allowed to sell their produce on favourable terms. The large, prolonged British military presence at the Cape served as a profitable outlet for the colonist farmers to dispose of their agricultural outputs (De Kock, 1924:87).[10] A major legislative change at the Cape during this period was the prohibition by the British Empire against slave importation into the Colony (Martins, 2019) aboard British vessels. The introduction of this legislation would have had a significant impact on the ability to acquire wealth, especially among later generations.

From 1811 until 1814, under the governance of John Cradock, the Cape experienced legislative changes towards a more liberal system. This period witnessed the introduction of perpetual quitrent agreements. A nearly uniform tax system was introduced to eliminate inequalities, with allowances being made to account for differences between Cape Town and more rural districts. To enact more stability at the frontier that faced frequent raids and skirmishes, Cradock commissioned a militia stationed in Grahamstown in 1812. This aided in circumventing any more significant hostile encounters and livestock raids for the remainder of the observation period. Giliomee (1982) maintains 1812 as a significant year during which the agricultural frontier also closed completely. The greater stability in Graaff Reinet may have undermined

[10] It has been empirically proven that ships harboured at the Cape served as significant outlet for produce cultivated at the Cape (Boshoff and Fourie, 2010; Fourie and van Zanden, 2013).

wealth mobility given that the presence of a militia reduced the social risk associated with residing here.

Upon his visit to the frontier in 1817, the subsequent governor Lord Charles Somerset was enamoured by the vast areas of unoccupied and fertile land on the East Coast of the Colony near the frontier. The governor consequently set out to lobby the British authorities in Europe to commence a process of systematic colonisation. The government accepted six thousand British settlers for colonisation of the region and each were given a tract of land of a hundred acres. This inflow of migrants may have contributed to diminishing the farm size in the frontier region as documented by Cilliers and Green (2018), especially given the closure of the frontier in 1812 (Giliomee, 1982). Many of these migrants, however, were not equipped to drive successful farming operations in the challenging geographic circumstances of the Cape Colony.[11] Although the government did offer them some support, many of the migrants abandoned their agricultural holdings and moved toward other trades.

A depression befell the Colony from 1821 until 1824 where the impact was not only experienced by settlers on the frontier, but also by those in the more established agricultural districts of the Colony. Farmers struggled to find an outlet for their produce during this period. While the British detained Napoleon on St. Helena, the island was a significant market for Cape produce with the sizable garrison stationed there. After his death and the conclusion of peace in 1821, however, the garrison drastically decreased in size and, with it, the demand for Cape produce as well. Along with this substantial decline in produce came public expenditures that were far greater than its revenue. This deficit resulted in a substantial depreciation of the currency (De Kock, 1924:91).

1.3 Dataset

In this dissertation, historical tax records of the Cape Colony, maintained by the VOC and later the British government, serves as primary data source. The governing authority calculated the amount of tax due to a settler household using these records. The *opgaafrollen* contained household-level data on household size, slaveholdings, number of Khoi employed and various agricultural assets and outputs. The assets include stock variables such as sheep, cattle, horses, goats and pigs, vines, wine and brandy supply and wagons and carts. The output variables include flow variables of various crops such as wheat, barley, oats and rye.

[11] The Cape was dry and windy making it difficult to farm with conventional crops like maize and corn.

This detailed, longitudinal dataset permits an investigation into the wealth dynamics of individual settler households and examine the evolution of inequality over a long period spanning up to seven decades. Linking the various annual records across years at the individual level, allows for the analysis of microlevel trends in wealth accumulation over time. The linking procedure employs the methodology developed by Rijpma, Cilliers and Fourie (2019) to link these annual, individual level records. The aforementioned methodology apart from first names, surnames and initials of household heads and vine ownership also relies heavily on the presence of a spouse and spouse names and initials. Therefore, a potential limitation of this dissertation is a bias toward married household heads. The reader needs to keep this limitation in mind as the dissertation makes comparisons of descriptive statistics at certain points. The nature of the dataset at hand, however, leaves little room for choice to achieve high linkage rates in order to obtain a workable dataset. It is necessary to include spouses in the linkage algorithm. The reader should be cognisant of this potential limitation of the dataset and dissertation.

Martins (2019) has used the data for the *opgaafrollen* of Stellenbosch in analysing the effects of the 1807 slave import legislation. Cilliers and Green (2018) most notably used the data for Graaff Reinet in their analysis of in-migration into the district, and Rijpma, Cilliers and Fourie (2019) developed an algorithm for string distance linkage to link the annual Graaff Reinet tax records across time.

The South African Families register (SAF) is an additional significant dataset that this dissertation also used – especially in Chapters 3 and 4. This dataset, which Cilliers (2016) comprehensively describes, contains demographic data on the residents of the Cape Colony. Of particular interest is the sibling and paternal data it provides, as well as birth and death year data. The latter allows for calculating the ages of the individuals contained in the o*pgaafrollen*. The SAF is linked to the *opgaafrollen* using an adapted string distance, machine-learning algorithm similar to that used in Rijpma, Cilliers and Fourie (2019). The inclusion of spouse names in the linkage algorithm again creates a potential source of bias that could be a possible limitation in this dissertation.

Each major chapter of this dissertation observes a different period covered by the *opgaafrollen*. Data availability, research objectives and research limitations determined the length of the observation period in each chapter. It is nevertheless prudent to note the sizes of the samples used in each Chapter since the dataset is a major focal point in this dissertation. Chapter 2

analyses 1805 until 1829 for Stellenbosch and 1805 until 1828 for Graaff Reinet for 23 years and 22 years respectively – after taking account of missing years.[12] The unlinked 23-year Stellenbosch dataset has 39251 data points compared to the 30371 data points for Graaff Reinet. The linked panel datasets where all households feature at least twice is 25309 and 31903 for Graaff Reinet and Stellenbosch respectively. The Graaff Reinet panel features more than 3000 unique households and Stellenbosch close to 5000. Since migration is the central concern of Chapter 3, the observation is 1775 until 1803 to control for possible changes in recordkeeping practices and boundary shifts. Since the chapter also links the *opgaafrollen* to the SAF to establish sibship characteristics and name inheritance, the sample features just over 10000 data points. In the case of Chapter 4, it is necessary to link the sons and fathers that both appear within the *opgaafrollen*. For the purposes of modelling the influence on mobility that a market shock such as the 1807 slave import legislation may have, fathers only appear after 1807. Using the seven-decade-long total unlinked panel extending from 1775 until 1844, these parameters limits the sample to 751 total data points and 213 unique father-son combinations.

1.4 Research design

The first part of this dissertation observes two districts. Data availability and the divergent geographic and economic characteristics in each district drove the decision on which districts were analysed. Located on the frontier of the Colony, Graaff Reinet came into existence in 1786. Extensive livestock farmers mainly (and sparsely) inhabited this district. Little crop farming and viticulture were practiced here because of the mountainous terrain and drier conditions. These geographic traits made conventional agriculture impractical. Secondly, the district of Stellenbosch was established in 1679. It was viticulture intensive with some crop farming also being prevalent. Some of the wealthier households also owned livestock. Wine and brandy were important outputs. This dissertation compares these two districts' levels of wealth mobility and the levels of out-migration it engendered.

Most research examining social stratification or mobility in a historical or pre-industrial context, examines occupational mobility (Van Leeuwen and Maas, 2002; Van Bavel, Moreels, Van de Putte and Matthijs, 2011; Knigge, Maas, Van Leeuwen and Mandemakers, 2014; Dribe and Helgertz, 2016; Cilliers and Fourie, 2018). Apart from occupational mobility, only Dribe and Helgertz (2016), examine lifetime earnings mobility for Sweden. In this dissertation, the

[12] When identifying an 'exit' from the district panel, the author takes care not to identify such missing years as 'exits' from either district panel.

unique dataset allows for examining agricultural wealth mobility. This strategy is particularly appropriate in the study at hand, given that in the districts that are analysed and the pre-industrial setting, the majority of individuals were farmers. Occupational diversity was, therefore, low for the period under observation. Additionally, the greater variance in wealth would make wealth mobility more representative of the actual individual experience of settlers in the Cape as far as opportunity for socioeconomic advancement was concerned.

In conventional historical wealth dynamics research, data is usually only available for isolated or snapshot dates at specific points in time. In the study at hand, however, the dataset allows observing changes in mobility annually and over a long period. The mobility estimations are then compared to the evolution of wealth inequality. Existing historical, mobility research is unable to provide a temporal view inequality persistence.

For as long as a settler household resided within a district's boundaries, they would have appeared in the district *opgaafrollen*. It is, therefore, possible, with the assistance of the demographic data in the SAF, to determine the settlers that migrated from a district. With the SAF, this dissertation distinguishes between settlers who disappeared from the *opgaafrollen,* either due to migration or due to death. The nature of the combined SAF and *opgaafrollen* dataset enables examining the relationship among wealth accumulation, migration and inequality persistence. The *a priori* expectation is for a negative relationship between wealth accumulation at the place of origin and a tendency to migrate in a historical context (Herscovici, 1998; Stewart, 2006; Abramitzky, Boustan and Eriksson, 2012). Therefore, the less likely individuals were of becoming prosperous relative to the wealthy households in their community, the more likely they would have been to seek fortune elsewhere. The research examining this thesis is deficient, particularly within African historiography. This dissertation improves on deficiencies by estimating wealth mobility models and survival models from which it calculates hazard rates for migration. No research attempts to reconcile migratory patterns with mobility in a Colonial African context. Migration in the Cape Colony has been documented (Fourie, 2013) and theories developed pertaining to the reasons behind this migration (Neumark, 1957; Guelke, 1976; Cilliers and Green, 2018). To the author's knowledge, empirical research examining the relationship between wealth and out-migration does not exist.

The SAF also contains information on genealogies. This allows identifying particular household heads contained in the *opgaafrollen* as siblings and parents of others.. The empirical

strategy followed informs of family dynamics and its contribution to adult economic outcomes among siblings. This dissertation investigates whether parental household characteristics could be another explanation for adult socioeconomic outcomes. Similarly, for nineteenth- and twentieth-century France, Kesztenbaum (2008) examines the proclivity of migrating and intra-familial characteristics. Results suggest that individuals' migration is dependent on the migration of their siblings. For a pre-industrial Finnish dataset, sexes of the elder siblings has a positive influence on the likelihood of younger siblings to migrate (Nitsch, Lummaa and Faurie, 2016). Given that the data consists of both genealogical information and wealth data, this dissertation expands upon the traditional household dynamics literature by examining whether personality differences among settler offspring caused by birth order differences, resulted in increased out-migration. It estimates survival models with birth order as a major dependent variable and include name inheritance as well to establish possible kinship or parental loyalty effects in a settler household's decision to migrate. This is a novel estimation strategy and the author is unaware of any existing research that has tried to establish these links in a pre-industrial context.

Existing wealth dynamics and mobility research reveal certain methodological issues. Most notably, the effects of lifecycle and period effects in estimating the level of mobility are potentially problematic. Lifecycle earnings, wealth or agricultural returns that is different between generations serve as basis for these estimation problems (Jenkins, 1987; Grawe, 2006; Nybom and Stuhler, 2016). Haider and Solon (2006) note such generational differences in reference to wealth persistence estimation, if different generations' income or wealth are measured at earlier points in their lifecycles. This dissertation has access to hundreds of father-son links at different ages, spanning from 1775 until 1844, with which to explore lifecycle effects on intergenerational mobility estimation. The long-term longitudinal dataset enables identification of period biases that may present themselves as lifecycle effects (Jenkins, 1987; Grawe, 2006). A significant date in the Cape, 1807, marks a change in slave import legislation. Because slaveholdings were a major productive asset in the Stellenbosch district of the Cape Colony (Guelke and Shell, 1983; Fourie, 2011; Martins, 2019), 1807 marks an ideal date across which to model the effects of macroeconomic or regime changes on intergenerational wealth persistence estimation that could potentially exhibit themselves as lifecycle effects.

1.5 Chapter summaries

1.5.1 Chapter 2

The majority of the existing research on wealth dynamics in the Cape Colony do not provide answers to the European settlers' ability to improve their socioeconomic status and the differences in migratory patterns it produced. This chapter compares agricultural wealth mobility of two districts of the Cape Colony with contrasting market and geographic characteristics and the out-migration from these districts. At the time of observation the first district, Stellenbosch, was more established. In this viticulture intensive region, slave labour was the preferred labour input – particularly among wealthier households. The second district is Graaff Reinet. This district was located on the frontier of the Colony and the focus of its inhabitants was on extensive livestock farming.

This dissertation theorises that these differences coupled with legislation in the Colony, created distinct opportunities for socioeconomic advancement. This chapter explores two major theories (Neumark, 1957; Guelke, 1976) that exist for the Cape Colony's migration patterns. The first theory (Neumark, 1957) views the frontier as being a place of high returns for settlers who accepted the social risk of migrating there. The second theory deems the frontier as being a haven that absorbed excess low-capital, low-skill farming households that failed to be successful in other parts of the Colony (Guelke, 1976). This dissertation estimates the inequality and wealth mobility in both districts.

The empirical findings suggest that Stellenbosch was by far the more unequal society. There were insignificant differences, however, between Stellenbosch and Graaff Reinet in terms of their unconditional absolute wealth mobility. There were no abnormal returns for settlers residing in Graaff Reinet in terms of agricultural wealth accumulation. This chapter next estimates survival models to establish the determinants of out-migration. Agricultural wealth is the major determinant of settlers persisting in Stellenbosch. Family size was the major determinant of households persisting in Graaff Reinet. The next step in the analysis then involves generating hazard rates from these survival models and including them in the models for mobility estimation. The findings from these models suggest that settler households that were less likely to exit the district of Stellenbosch were the ones that were more likely to exhibit convergence in terms of their agricultural wealth holdings. In Graaff Reinet, this convergence-migration effect becomes prominent only after frontier closure. This delay confirms the

increasing difficulty of practising extensive livestock farming after the frontier closed and land grew in short supply as is consistent with the findings of Cilliers and Green (2018).

1.5.2 Chapter 3

Research concerning modern contexts have generally yielded mixed evidence as far as birth order and socioeconomic outcomes are concerned. (Taubman and Behrman, 1986; Majoribanks, 1989; Draper and Hames, 1999; Guastello and Guastello, 2002; Milne and Judge, 2009; Sulloway, 2010; Rohrer, Egloff and Schmukle, 2015; Rohrer, Egloff and Schmukle, 2017; Breining *et al.*, 2020). While some studies are in favour of birth order having a significant effect on adult economic outcomes, others yield little evidence supporting this. The major channel through which these outcome differences could manifest is personality differences among offspring resulting from their birth order. More offspring born in a household implies a thinning out of parental care, time and resources over this larger sibship. These limited resources could result in competition among siblings or them attempting to occupy different familial niches to differentiate themselves. Alternatively, regardless of birth order, siblings would adjust their response to different circumstances, which would yield no consistent method of identifying birth order as a determinant of adult socioeconomic outcomes.

Naming conventions, additionally, has also featured as explanation for parent-offspring relationships. In earlier times, parents attached much significance to offspring names. This dissertation considers naming conventions as being an indicator of cultural familial ties (kinship) or loyalty effects between parents and offspring. Offspring sharing names with their parents or elder kin may have a closer familial tie, serving as incentive to migrate further from the familial homestead.

Consistent with modern research, this chapter attempts to rule out psychological mechanisms in driving migratory decisions from Stellenbosch, through the vehicle of either siblingships or naming conventions. Given the close relationship between birth order and naming conventions, however, it becomes necessary to distinguish between the two in the statistical analyses.[13] This distinction allows for determining if migratory or wealth accumulation patterns were because of kinship or loyalty effects (soft issues) or resource constraints (material issues).

This chapter employs a dataset that consists of the linked *opgaafrollen* and the SAF register. This chapter presents estimates of survival models with birth order and name inheritance as the

[13] Results in Chapter 3 suggest that third born sons generally inherited their fathers' name.

major variables of concern. In an expanded sample, this dissertation found that birth order had a significant negative connection with likelihood to exit the district of Stellenbosch. This means that the earlier born siblings were less likely to migrate. This result is not necessarily due to loyalty effects. Name inheritance do not exhibit any significant effects on migratory decisions. Instead, earlier born sons may have inherited more agricultural resources, permitting them to persist in the district of their father for longer. In the context of the pre-industrial Cape Colony, this chapter rules out statistically significant personality effects determining socioeconomic outcomes and geographic persistence. Instead, intergenerational transfer of resources to older offspring is, therefore, a more likely explanation of socio-economic outcomes. In substantiation of this, following an estimation of a model of wealth determination, birth order was negatively associated with a settler's level of agricultural wealth. Owning more agricultural wealth, after controlling for age, elder siblings were more likely to persist in Stellenbosch. Being the "first-movers" to enter an industry and having more knowledge of the familial agricultural operations, this persistence was likely due to the eldest male siblings inheriting more handsomely from their fathers. This chapter consequently rules out soft issues such as birth-order-induced personality differences and kinship as significant determinants for elder sibling persistence.

1.5.3 Chapter 4

Chapter 4 examines a significant issue as far as estimation of intergenerational mobility is concerned. Modern literature suggests that reneging on including controls for lifecycle and period effects would result in biased estimates of intergenerational mobility. Measuring wealth at different points in the fathers' lifecycles may result in biased estimates. Period effects that present themselves as lifecycle biases in wealth accumulation are potentially problematic as well. Varying macroeconomic contexts are cause for such problems.

This chapter utilises a long-run longitudinal *opgaafrollen* dataset linked to the SAF to control for potential biases. The long period of data available, allows linkage of several years of agricultural wealth for father and son pairs, measured at the same age and in the same period. Conventional intergenerational mobility research, in contrast, make use of census data to link fathers' and sons' socioeconomic variables across time at (sometimes) different ages (Ferrie, 2005; Bailey and Dynarski, 2011; Erikson, Goldthorpe, and Hällsten, 2012; Long and Ferrie, 2013). Studies like these only provide snapshots of wealth for different generations. They do not allow for controlling period biases. The methodological strategy includes two approaches that controls for both lifecycle and period biases. The first estimation approach estimates the

wealth mobility between sons and fathers in cross-section. This approach measures both generations after the 1807 changes to the slave import legislation. It avoids the potential for period biases, resulting from regime change and that present themselves as lifecycle effects. The major issue with this approach though, is that fathers and sons are at different points in their lifecycles. Consequently, it becomes necessary to include controls for birth year and current year. The former is a control for generational and lifecycle differences. The latter is a control for the varying macroeconomic contexts of each father-son pairing in the sample.

The second round of analysis involves estimating the wealth mobility for fathers and sons measured at the same age. This strategy circumvents lifecycle biases but exposes estimates to period biases. Fathers' and sons' levels of wealth are measured in different macroeconomic contexts. In this estimation, it is, therefore, necessary to include age and period of age controls. This chapter includes the former control, given that it necessarily measures the various father-son pairs appearing in the sample at different ages relative to other father-son pairs. The latter control is to account for the different macroeconomic contexts in which the fathers' and sons' wealth is measured. Results suggest that lifecycle and period biases exert significant effects on intergenerational mobility estimation. Not controlling for these effects results in an overestimation of the persistence of intergenerational wealth transmittance.

1.6 Conclusion

A major factor in the lack of sufficient research devoted to African historiography is the lack of quality, longitudinal data over the long run. Recent years, however, have witnessed a data revolution that has given way to a 'renaissance' in African historiography (Fourie, 2016). This dissertation has access to an expanded, longitudinal digitised version of the Cape Colony's tax records that spans nearly seven decades (Fourie and Green, 2018). With data from an extended period and expanded longitudinal geographic coverage, it is possible to examine questions that have not yet received attention.

In this dissertation, focus is on three major themes concerning the Cape Colony: wealth mobility and its effects on out-migration, siblingship induced personality differences affecting migratory patterns and the influence of lifecycle and period biases on intergenerational mobility estimation. The need for improved understanding of South Africa's past as it relates to inequality and wealth mobility qualifies the significance of this dissertation. Such understanding provides context for the current state of wealth distribution in South Africa and its potential long-term future trajectory. It further serves as framework on how to analyse

questions relating to wealth mobility and migration and further serves as contextualisation for policymakers on the extent of South Africa's inequality and wealthy distribution issues from a historical perspective.

The major findings in this dissertation is that those settler households that were most likely to exit a particular colonial district, were the ones that showed the lowest level of wealth mobility. The dissertation ruled out significant birth-order induced personality effects in determining a household's exit from the district of Stellenbosch. Although earlier born sons were less likely to migrate, it was because they were better endowed with agricultural wealth than their younger siblings were. It is furthermore crucial to properly control for both lifecycle and period biases when modelling intergenerational wealth mobility. Failure to do this would result in biased mobility estimates.

In conclusion, wealth dynamics in the Cape Colony has not been as stagnant as traditionally believed. Opportunities for socioeconomic advancement did exist. Prospects for abnormal returns were not present, however, not even at the volatile agricultural frontier. Settlers moved around in the Cape mainly due to their wealth position and disillusion with deficient opportunities for agricultural wealth mobility. Birth order and name-inheritance-induced motivators played no significant part in explaining out-migration. Earlier born sons inherited more wealth from their fathers and this served as stimulus for persisting in a particular district in the pre-industrial Cape Colony where capital was limited and agricultural wealth was concentrated in the more established regions. An important methodological caveat to consider when estimating intergenerational mobility is to control for lifecycle and period effects as they may lead to biased mobility estimates.

Chapter 2

2 Migration and wealth mobility: Was the frontier speculative or a safety valve society?

2.1 Introduction

In modern contexts, migration is mostly associated with positive selection: predominantly highly skilled individuals move to locations where their human capital has higher returns compared to their home regions (Borjas, Bronars and Trejo, 1992). Negatively selected migration, however, is also possible if there is an oversupply of low-skilled work in an individual's home region. This is typically true in early phases of development, when low population density and open borders allow the in-migration of unskilled or semi-skilled workers. Abramitzky, Boustan and Eriksson (2012), for example, suggest negative selection among Norwegian migrants from urban regions for the United States during the age of mass migration. In other words, less well-off Norwegian migrants in the urban areas were more likely to migrate to the United States. As an escape, Norwegians with lower economic prospects were more likely to migrate to the United States in search of greater opportunities.

When considering international labour migration, Hatton and Williamson (2006) note that low migration costs favour negative selection. McKenzie and Rapoport (2010) proves this thesis for Mexico-US migrants. Negative selection is more prevalent in societies with strong migrant networks. The low entry costs of migrating elsewhere in the Colony from the more established regions could make this thesis plausible in a pre-industrial context as well. First-moving settlers' ability to establish themselves in areas of the Colony with less competition and lower capital requirements would compensate them sufficiently for their failure in the more established regions of the Colony. Negative selection migration, therefore, allowed the broader economy to evolve into an aggregate wealth-enhancing path: the departure of poorer settlers from established districts raised wealth in those areas; the establishment of new farms in previously unsettled areas enabled economic mobility among this poor group. The result is economic growth at an extensive margin. Borjas (1987) theorised that negative selection would be more likely when the income distribution of a sending region is higher. In such a scenario, the receiving region would select migrants found lower on the income distribution in the origin region.

Whether the same holds true within a settler economy is not yet certain. In earlier research, Neumark (1957) posits that residents of the Cape Colony at the southern tip of Africa mainly migrated to frontier districts because there were greater opportunities there as opposed to the already established districts. More capital was required in the Stellenbosch district Neumark (1957) argues, and migration was, therefore, a sensible alternative for the economically vulnerable. Those settlers with little capital regarded the frontier as a more 'lucrative' option.

In contrast to Neumark (1957), Guelke (1976) argued that the frontier was not a region characterised by abnormal returns. It was not more lucrative in terms of agricultural returns otherwise one would have expected wealthy Cape settlers to highly regard the investment opportunities at the frontier. The low interest among wealthy arable farmers for potential investment opportunities at the frontier suggest there were no opportunities for such abnormal returns. Instead of looking to the frontier, wealthy arable farmers in the region around the Cape instead competed against one another for monopoly leases at annual auctions. The frontier, nonetheless, represented an outlet for people with little to no capital (Guelke, 1976). Sustained, long-term growth prospects at the frontier were limited and did not represent an investment opportunity for profit seekers. According to Guelke (1976), the frontier was a society of self-sufficient livestock farmers that was isolated from the central economic hub of the modern-day Cape Town.

Guelke's (1976) findings are, therefore, in line with the results of Abramitzky, Boustan and Eriksson (2012) in that migrants tended to be negatively selected from the more established regions of the Colony. While there may not have been abnormal returns at the frontier, it still served an important purpose in absorbing migrants from the more established regions that were unsuccessful in the winemaking industry and had little capital. The lower cost of entry into the frontier's productive economy would therefore make negative selection from the more established regions more likely.

This chapter focus on the reasons for out-migration by examining household-level information for the Cape Colony from 1805 until the late 1820s. Earlier research examined aggregate wealth dynamics of the Cape Colony, specifically for the period leading up to the first British occupation in 1795 (Du Plessis and Du Plessis, 2012; Fourie and Uys, 2012; Fourie, 2013). In the only study, that empirically examines intergenerational wealth mobility at the Cape Cilliers, Fourie and Swanepoel (2019) use the *opgaafrollen* collected annually that documents the

wealth of settler households.[14] This chapter uses a similar but expanded dataset (Fourie and Green, 2018), including later years and more districts to assess inter-district differences in household wealth mobility. The aim is to know whether farmers migrated out of desperation for remaining poor, or whether they moved because of a higher likelihood of upward mobility in their destination district.

This is therefore a unique case study analysing a pre-industrial society's response to the introduction of more market-friendly legislation following a long period of authoritarianism. Entrenched institutions at the Cape included extensive, large-scale farming, dependency on slave labour as a major production input, and ease of migration. The chapter analyses the ability of farmers to accumulate wealth in this aforementioned context, upon the introduction of more liberal, market-friendly legislation and their response in the form of migration if they did not become wealthy.

The results presented in this chapter contribute to historiography beyond the Cape Colony. Studies such as Walker (2000), Hall and Ruggles (2004) and Stewart (2009) count among the research providing evidence that migration to the frontier (in these three cases for the late nineteenth century United States), may have supported the wealth accumulation prospects of migrants. This chapter intends to prove that this was also the case for the Cape Colony and, in doing so, contribute to a literature that is deficient in evidence from pre-industrial, historically underdeveloped societies.

The layout of this chapter is as follows: Firstly, this chapter discusses the context of the Dutch Cape Colony. This section will also feature a brief description of the data sources used in this chapter. Section 3 provides a review of the prevailing literature on social mobility in past and pre-industrial societies. This section elucidates some of the more prominent theories and pays particular attention to how structural shifts affect the level of convergence.[15] Section 4 describes the data and explains the methods used in the analysis. Section 5 presents the results of the analyses and section 6 summarises and concludes.

[14] Cilliers, Fourie and Swanepoel (2019) find high levels of intergenerational mobility at the Cape – particularly among the lower class individuals. In this chapter, instead of examining intergenerational mobility, the focus is on intragenerational mobility. The current analysis models the mobility of individuals across time and explores how such mobility may motivate migration.

[15] In the study at hand, structural shifts would refer to changes in land tenure legislation that was proclaimed, which changed the prevailing fifteen-year quitrent system to a system where fifteen-year quitrents could be converted to ninety-nine year perpetual quitrent tenures (De Kock, 1924:88). This would have had positive effects on property rights and, presumably, affected mobility.

2.2 Background and literature review

The Cape Colony of the eighteenth century has a wealth of quantitative sources available to test hypotheses (Fourie, 2014). This chapter uses a complete source of tax censuses to understand the wealth dynamics of the Cape settlers. To achieve this, it first discusses living conditions at the Cape.

2.2.1 Dutch Rule and British occupations (1652–1806)

April 1652 marked the arrival of the Dutch East-India (VOC) at the Cape. The primary instruction of the VOC to Commander Jan van Riebeeck was to establish a halfway house to replenish the supplies of trade ships passing the Cape on their voyages between Europe and the East. However, in 1657 the Assembly of Seventeen deemed it necessary to release several VOC employees into the immediate vicinity of Table Bay. The orders to these so-called *free burghers* were to occupy and establish arable farming operations near the fort. The release from company employment was to strengthen the garrison of the VOC at the Cape and to minimise the maintenance of the Company. Geographically the Colony grew considerably until 1795, as *free burghers* settled in new areas (Fourie, 2013a).

According to De Kock (1924:18), restrictions on trade, the land tenure system and skirmishes with indigenous tribes partially supported eastward expansion of the Colony. Neumark (1957:17) disputes the introduction of loan agreements replacing freehold land as motivation for settler dispersion. Swanepoel and Fourie (2018) substantiates this position through their argument that changes in land tenure did little to affect *de facto* property rights – even if *de jure* property rights were. Instead, in the absence of sufficient labour and capital, many settlers opted for extensive livestock farming. Livestock farming required far less capital at start-up, and, therefore, it was a more economically lucrative venture for settlers to pursue. The frontier region's excess of unoccupied land, the mountainous terrain and close proximity to Khoi pastoralists, made it the preferred location for livestock farming. In the earlier periods of VOC presence at the Cape, agricultural supply in the form of provisions to passing ships was equal in demand. With the expansion of the Colony, however, supply started to exceed demand as the VOC banned free foreign trade. These foreign trade controls caused a substantial decline in domestic agricultural prices and threatened farmers' livelihoods. Neumark (1957:16) proposes that conflicting interests of settlers and the authorities served as sufficient motivation for arable farmers to migrate to the frontier to pursue livestock farming.

Thus, the younger residents of the colony – mostly the sons of the earlier generation farmers – grew disgruntled with the foreign trade policies (among other issues) of the VOC and its negative impact on commercial agriculture (De Kock, 1924:19). Many settler farmers found travelling inland beyond the mountain ranges and pursuing livestock farming the most obvious alternative. Neumark (1957:17) characterises the frontier region as being more 'lucrative' for settlers, compared to the more established, arable farming-oriented regions of the Colony. Inland migration of discontented colonists continued throughout the eighteenth century. Eventually the VOC annexed the newly settled frontier region into the existing Colony, even though the Company might have been opposed to expansion initially.

It is understandable to conceive that the loan tenure system, and the supposed insecure property rights is seen a contributing factor to migration. Conventional belief is that a significant step away from the loan tenure system in 1813 toward perpetual quitrents, substantially improved the psychological security of land ownership among settlers. Prior to 1813, insecure land rights discouraged settlers to make substantial capital investments in the land which they occupied (De Kock, 1924:30). Nevertheless, Neumark (1957:16) disputes such beliefs: frontier expansion persisted, and even accelerated after the introduction of a more 'secure' land tenure system. In fact, graziers may have used the loan tenure system to their advantage. Loan tenure agreements may have served as a conduit through which graziers acquired larger tracts of land to support their growing herds of livestock.

Did these geographic expansions translate into an improved economic status of the Colony's inhabitants? In the early eighteenth century settlers could be divided into three distinct groups: townsmen living in close proximity of modern-day Cape Town, arable farmers residing in the Berg River valley, and livestock farmers grazing much further inland beyond the *Hottentots Holland* mountain range (Walker, 1941:69).[16] *A priori* expectations are for significant differences existing in wealth accumulation between two major groups of Colony inhabitants – the arable farmers in the Stellenbosch district and the livestock farmers of the Graaff Reinet district.[17] Stellenbosch was the more established district (having existed since 1679) with more challenging entry into agriculture, whereas Graaff Reinet was much younger (established in

[16] The Berg River is situated about 280 kilometres south of the 1795 northern-frontier border and about a 1000 kilometres west of the 1795 eastern frontier border. The Hottentots Holland mountain range is located about 800 kilometres west of what was the Eastern frontier of the colony in this chapter.

[17] Stellenbosch is situated more than a thousand kilometres west of the eastern frontier border in the form of the Great Fish River and approximately 500 kilometres south of the Northern frontier. Stellenbosch is about fifty kilometres from the Castle of Good Hope in which governors of the colony resided.

1786) and less populated.[18] Livestock farming demanded substantially less start-up capital than what viticulture required in Stellenbosch. Barriers for socio-economic advancement were not as prevalent in Graaff Reinet as in Stellenbosch. Conventional economic models contend that migrants weigh the costs of migrating against the expected future returns of migration (Sjaastad, 1962; Mincer, 1978). The sustained increase in the Graaff Reinet population suggests that the costs of moving to the frontier at the very least did not outweigh the costs of persisting in more established districts. Similarly, to the American frontier examined by Stewart (2006) and Stewart (2009), greater economic opportunity was available to migrants of all ages that were forced from the established district toward the Colony's agricultural frontier.

There was a possibility for settlers to obtain considerable material prosperity, especially near the central economic hub of the Colony (De Kock, 1924:22). The traditional historiography suggests, however, that a majority of the population scraped by through subsistence agriculture. Müller (1979:26) in particular, notes the difficulty experienced by settlers living on the frontier of the Colony. The structural characteristics of the Colony resulted in it being underdeveloped, backward and having lacklustre in economic expansion (De Kock, 1924:40; De Kiewiet, 1941:30; Müller, 1979:27) in comparison with their European peers. These inhibiting characteristics included that included trade restrictions, the loan land tenure system, and the major objective of the VOC to curb costs wherever possible, including not investing in intensive farming methods at the Cape. Consequently, the opportunity for society to promote upward economic mobility was limited.

Recent empirical evidence has disputed these orthodox perceptions of the backward socioeconomic status of settlers at the Cape. In employing probate inventories of the Cape Colony Orphan Chamber, Fourie (2013a) finds that the wealth of settlers from 1652 until 1795 was underestimated. During the eighteenth century the living standards of the average Cape settler was at least on par with those reported by their European counterparts. Poor European immigrants were able to substantially improve their economic position within a short period, though wealth remained unequally distributed (Fourie and von Fintel, 2010a; Fourie and von Fintel, 2011). De Zwart (2011) and Du Plessis and Du Plessis (2012) show that average real wages increased continuously. Real wages, although still high, increased relatively slower during the nineteenth century than those documented in contemporaneous Europe (De Zwart,

[18] Being more densely populated and given the focus on winemaking instead of livestock farming as was practiced on the frontier meant less availability of quality arable farming land for late-arriving prospective wine farmers. In addition, far more initial capital was also required to start a winemaking venture compared to a livestock farming operation.

2011). Fourie and Uys (2012) advanced comparable findings. They show that the luxury goods consumption at the Cape was substantial. Even poor households had some luxury items. Nevertheless, evidence in their research points toward household ownership being variable across different wealth groups. Such variability in household wealth implies substantial levels of inequality.

2.2.2 The Cape under Imperial British Control (1806-)

In 1806, with an increase in the hostilities between France and Britain, the Imperial British Government deemed it necessary to capture the Cape and bolster its military power. The British upheld many of the legislative changes introduced by the Batavian government in their 1803 to 1806 rule. In the interior, farmers retained the right to sell their produce at favourable terms, with a lucrative market supported by high military expenditures. The British introduced notable additional legislative changes between 1811 and 1814, including a revision of the land tenure system in 1813.[19] This amendment to land tenure granted farmers greater *de jure* property rights – even if *de facto* rights were more or less unchanged (Swanepoel and Fourie, 2018).[20] In addition, the Colony saw the introduction of a uniform tax system. The British also instituted a commission of inquiry to determine the cause of inflation. This active and liberal approach acted to stimulate the Cape economy. According to De Kiewiet (1941:36), the British injected large amounts of money into the economy between 1811 and 1819 in an effort to stimulate business activity. This granted considerable assistance to those settlers cultivating vineyards.[21]

George (1929) noted that frontier land values appreciated with the increase in the settler population. Cilliers and Green (2018) also supported such appreciation. Consequently, land rents served as a major channel through which migrants' wealth increased. However, this

[19] The traditional loan lease land system was replaced (albeit systematically) with a perpetual quitrent system. Instead of settlers paying rent for the land which they occupied, all new land issues took place on perpetual quitrent tenure. This meant that settlers acquired ownership of the land and received the title deeds thereof (De Kock, 1924:153). Existing loan leases could be converted to perpetual quitrent upon formal application. The perpetual quitrent tenants were still expected to pay an annual rent for the occupation, even though they had full ownership. The rent was calculated on the fertility and general conditions of the land. The quitrent could be transferred across generations, the estate could be sub-divided, and the property could be sold either in part or as a whole. Holders of perpetual quitrents could legally do with the property as they pleased. Quitrents were, therefore, quite similar to freehold farms.

[20] It is important to note that in a more recent study it is suggested that *de facto* property rights for loan-lease land tenure was no less secure than the *de facto* property rights under freehold tenure, even though *de jure* property rights might have been considerably different (Swanepoel and Fourie, 2018). In another study by Dye and La Croix (2018), it is argued that among the major motivations behind the transition from freehold land tenure to loan tenure was to accelerate the appropriation of land by the VOC in the midst of a dwindling Khoi population. It was a cost-effective way to quickly occupy land and expand Dutch pastoral activities.

[21] After 1819 there was a major slump in prices which Neumark (1957:32) attributes to the supply of wine outstripping the demand for it.

would naturally mean a start-up would be more expensive to finance later on when land values appreciated. This very early study, therefore, supports the implications underlying the Ricardian model of wealth distribution. Kearl, Pope and Wimmer (1980) also confirm this support in their analysis of mid-nineteenth century Utah, United States. The changes witnessed at the Cape regarding land ownership would also support this theory. As more settlers migrated toward frontier regions, the higher demand for land raised its value. The increased land value would have positively affected settlers' bartering power and their overall wealth position. In contrast, households arriving later would have needed more capital for a livestock farming start-up as areas of available land diminished. Cilliers and Green (2018) find that closure of the frontier and an increasing population at the Cape during the early nineteenth century, resulted in land availability decreasing. Poorer households reacted differently to wealthier ones in their allocation of production inputs. The former substituted less available land for greater household member labour input, while wealthy households substituted land for capital to obtain greater market access. Gregson (1996) supports the thesis that migrants arriving earlier at the frontier accrued greater benefits in terms of capital gains on land, but also from location specific knowledge gained. This would have made the frontier an increasingly challenging location to thrive for those migrants arriving later.

Land ownership plays an integral role in wealth distribution in the largely agrarian economy of the Cape. Changes in the land tenure system had the potential to affect wealth accumulation and the level of inequality. According to Van der Walt *et al*. (1966), the governing authority introduced changes in land tenure for greater stability in the frontier regions for the Dutch. Dye and La Croix (2018) also argue this. The long administrative processes associated with transferring the title deeds, however, resulted in many impatient farmers migrating as soon as droughts and pestilence forced them to. Other farmers opted to wait it out to realise the windfall from selling their deeds as soon as they acquired them. Applying for grazing permits and a loan agreement for grazing pastures were much faster and cheaper to process.

In a pre-industrial, agrarian society as in the eighteenth and nineteenth century Cape, an important aspect of wealth accumulation is land ownership. Intuitively, land at the frontier was more freely available given the sparse population density. Stewart (2006) uses the concept of the agricultural ladder, as conceptualised by Spillman (1919), to explain how land ownership impact on wealth accumulation in the US. Even though nineteenth-century US families migrating to the frontier were poorly endowed in terms of wealth or human capital, they were nonetheless able to accumulate wealth faster than their wealthier counterparts in urban areas

were. This wealth accumulation is realised through land rents and capital gains as the population at the frontier increased. Ferrie (1997) and Herscovici (1998) corroborates the relationship between wealth accumulation and migration in the nineteenth century United States.

2.3 Methodology

The wealth dynamics and income mobility literature uses various approaches to measure the degree of mobility in a society. Fields (2008), in his review article, states that "at least 20 mobility measures have been used in the literature". In this chapter, mobility is estimated in terms of regressing the level of wealth in a subsequent period on the change in wealth in a base period (Chadwick and Solon, 2002; Gong, Leigh and Meng, 2012; Bjorklund, Jantti and Roemer, 2012; Blanden, Gregg and Macmillan, 2013).

Conventionally, occupation has been used as a robust measure of social status in examining social stratification (Maas and Van Leeuwen, 2002; Van Bavel, Moreels, Van de Putte and Matthijs, 2011; Knigge, Maas, van Leeuwen, *et al.*, 2014; Dribe and Helgertz, 2016). Using this measure, however – especially in the case of the Cape Colony – has often been a last resort in the absence of detailed income or wealth data. There were a number of artisans residing in what is modern-day Cape Town, and some parts of the Stellenbosch district. The majority of people in the Cape during the period of observation in the late eighteenth and early nineteenth centuries, however, practised agriculture. Analysis of occupational mobility is, therefore, not entirely appropriate for this dissertation's specific period of analysis.[22] As mentioned by Van Leeuwen and Maas (2010), there is greater variance in income and wealth than in occupational mobility in a pre-industrial society where job opportunities were limited and the education system was in its infancy, or, in the case of the Cape Colony, non-existent. For the study at hand, the greater variance in agricultural wealth is crucial to the analysis of wealth distribution, in determining how entrenched inequality was and examining the extent of social stratification. The major difference between European settlers at the Cape and their European counterparts was the access to an abundance of fertile land on which to farm. These abundant supplies of fertile land at the Cape and the lack of occupational differentiation are why studying wealth

[22] Cilliers and Fourie (2018) examined intergenerational occupational mobility during the industrial take-off of the Cape over the course of the nineteenth century. This dissertation examines the late eighteenth and early nineteenth centuries when extensive farming still dominated the Cape economy.

mobility at the Cape is the more appropriate research approach.[23] The *opgaafrollen* provide the means to execute this preferred strategy.

2.3.1 Micro-convergence model

This chapter estimates an equation that adopts the form of a micro-convergence model, adapted from the macro-convergence literature of Barro and Sala-i-Martin (1992) and Quah (1996). In algebraic terms:

$$\Delta y_t^* = \beta_0 + \beta_1 y_{t-k}^* + \beta_i X_t' + u_t \quad (1)$$

In Equation 1, Δy_t^* denotes the change in the natural logarithm of a wealth index of settlers between the base year and the subsequent year.

In this chapter, the wealth measure is a composite wealth index. This chapter employs Principal Component Analysis (PCA) to construct the index from a selection of agricultural assets.[24] The analysis employs this measure given potential asset inflation, absence of many asset prices, and some productive assets too difficult to value accurately – such as vines. All assets for which the *opgaafrollen* had a continuous and complete time-series were included in the PCA. Refer to Section 2.4 for a brief description of these datasets.

The natural logarithm of the base year wealth index is denoted by y_{t-k}^*, with the β_1 coefficient approximating the beta-convergence present. The length of the window over which this chapter estimates mobility is k.[25] Conventionally, when the micro-convergence model is applied in mobility research, researchers only have two sets of data that are spread years apart. Data availability of quality wealth or income census data normally dictates the length of time between the years. The number of variables in the vector of explanatory variables is denoted by i, while t is the annual observation for each parameter for each individual.

The dataset used in this chapter – that is nearly three decades in length – allows for tracking the wealth of individual settler households over a relatively long period. Estimation consequently generates wealth mobility coefficients on a rolling basis over a five-year window to model the evolution of mobility over the course of two decades; k in this model, therefore,

[23] With the Cape acting as resource supplier to passing ships, and since the region was characterised by large expanses of open land, especially in the interior, farming was the logical economic activity to pursue. Fertile land along the coastal belt of the Colony was particularly suited for extensive viticulture.
[24] The exact methodology is explained in Appendix A.
[25] This 'window' refers to the length of time in years between the base year and subsequent year across which mobility is estimated.

equals five.[26] Since this analysis compares the experience of settlers in terms of their mobility in two different districts of the Cape Colony, it is crucial to ensure that the choice of the window period measured in the models for both districts is the same. This aim is to determine if one district was more mobile than another was, over an x number of years. A longer window period would have afforded a settler household a longer time in which to acquire wealth.

A $\beta_1 < 0$ indicates convergence. This means that poorer households exhibit a greater tendency to improve their wealth relative to richer households. In contrast, a society where $\beta_1 > 0$, is characterised by having divergent, anti-poor growth or anti-rich contractions in the economy. Households with a greater level of starting wealth, tend to exhibit greater positive changes in their wealth. *A priori* expectations are that β_1 estimates should mostly be greater for Graaff Reinet compared to Stellenbosch, given that the latter was more established with fewer opportunities for poorer or late-arriving households. Graaff Reinet, on the other hand, was more volatile and sparsely populated. The dynamism present at the frontier potentially creates the ideal conditions in which opportunities for economic advancement could proliferate.

X denotes an i number of control variables included in the model alongside the natural logarithm of the wealth metric in the base year, y^*_{t-k}, for a particular settler household. The mobility coefficients estimated here are conditional mobility since it is conditional on a number of other control variables included in the model. In the pre-industrial context observed in this chapter, such covariates would include a metric for how diversified a household's agricultural production was. The author expects more diversified households to be better equipped at weathering negative market shocks to any one agricultural asset and hence have a more persistent level of agricultural wealth compared to their less diversified counterparts. The model also includes categorical variable for the preferred labour input of each settler household. Households with a preference for slaveholdings as labour input into are able to realise economies of scale in their agricultural production relative to households relying only on household labour, for instance. Expectations are that household relying on slaveholdings for the majority of their labour inputs into agricultural production would exhibit greater positive changes in their agricultural wealth compared to household relying on Khoi or household

[26] The choice of window is arbitrary but impacts on the size of the mobility coefficients obtained. Given this chapter's interest in knowing how much wealth has changed over a particular period of time, longer periods would on average see larger wealth changes and vice versa. The window size is not an issue if long differencing has the same impact in both districts. However, longer differencing minimises the impacts of measurement error. For instance, estimates stretching over two years, yields much lower mobility and smaller differences across districts. However, this chapter attributes this to measurement error, and an insufficient time to warrant significant wealth accumulation.

labour. Household size is another potential significant covariate included in the model. An argument could be made that in the pre-industrial context of the study at hand, settler parents would only have had more children if they had the resources to adequately care for greater numbers of offspring. The dissertation, therefore, expects a positive relationship between household size and change in the level of wealth.

An important covariate included in a later incarnation of the conditional mobility model is the marginal hazard rate of a settler household dropping out a district sample. This model also includes an interaction term constructed from the base year agricultural wealth and the aforementioned hazard rate. Including the hazard rate and the interaction term models whether households that were more or less likely to exit a particular district were those that showed greater or lesser levels of agricultural wealth mobility. The ideal scenario would be to return significant coefficients for the base year wealth and the interaction terms of opposite signs. A significant and negative mobility coefficient with a significant and positive interaction term coefficient would indicate that those settlers more likely to exit a district would have been those that experienced less agricultural wealth convergence. In contrast, a significant and positive mobility coefficient and a significant and negative interaction term would indicate that households would have been less likely to migrate out of a district under the condition of lower levels of divergence.

2.3.2 Survival analysis

To capture the migration suggested to have been present in the Cape Colony, the empirical strategy involves employing survival analysis. Survival analysis is simply concerned with modelling the likelihood of a subject – in this case settler households in the Cape Colony – dropping out of a particular sample and what the drivers behind this disappearance from the sample were.

An important caveat to note here is that at this point there may be several reasons why a household 'left' the dataset: poor record-keeping, death, and of importance in this chapter, out-migration. This chapter assumes that the majority of 'exits' from the sample are in fact due to migration. The chapter repeats survival analysis of migration later on with a limited sample of households with death year data for the household heads, in an effort to corroborate the findings. For this limited subsample consisting of confirmed deceased settlers, the dissertation estimates similar survival function coefficients. This illustrates that although there might be

some households present in the overall sample that dropped out because of death, it does not have a significant impact on the overall results of the survival analysis.

It would have been ideal to have a large, overarching dataset encapsulating all districts in the Cape Colony; however, such a dataset is not available at this stage. A colony-wide dataset would have permitted following a particular household as it moved across different districts. This would have enabled the dissertation to provide explicit answers to whether or not the households moved for better wealth-generation prospects. This chapter takes an implicit approach in examining the characteristics of households that dropped out of a particular district, prior to the final observation year of the sample.

With the aim of determining the 'costs' that motivated exit of settlers from each district, it is necessary to examine whether mobility (or lack thereof) was a determinant of settlers dropping out of each district panel. Was the level of convergence (or lack thereof) in the two Cape Colony districts being analysed in this chapter, associated with a greater likelihood of out-migration? This question captures the crux of this chapter.

Using a complementary log-log survival model, the dissertation generates predicted hazard rates of households leaving a district. The model includes the independent variables of household size, the labour inputs (slaveholdings and Khoi labour), and production diversity to control unique household characteristics. The model also include dummy variables controlling time effects. This chapter then proceeds to include these predicted hazard rates as additional covariates in the micro-convergence model to determine their relation to changes in the wealth index.[27] Results from this analysis enables confirmation of whether households migrated from Stellenbosch after they witnessed a decline in their relative wealth, or whether Graaff Reinet was a speculator society, characterised by households leaving the district shortly after acquiring wealth.

Algebraically the complementary log-log survival model is expressed as follows:

$$\Pr(y_j \neq 0|x_j) = 1 - \exp\{-\exp(x_j\beta)\} \qquad (2)$$

where $F(z) = 1 - \exp\{-\exp(z)\}$.

[27] This method of calculating the marginal hazard rate is to control possible sample selection bias as explained in Heckman (1979). The model estimates the marginal likelihood of a household exiting the district, whilst controlling for particular household characteristics. This permits the correction of any sampling bias that may arise by working with a potentially non-random sample. Working with marginal hazard rates, it allows for confident extension of the size of the hazard to all households not potentially present in the sample.

Equation (2) represents the basic form of the binary outcome complementary log-log model. It models the probability of a specific outcome occurring given a set of control variables. Naturally, the dependent variable is binary where 0 would indicate failure of an outcome occurring and 1 indicating a successful outcome occurrence. The function calculates probabilities from a cumulative probability density function given a set of control variables.

In the study at hand, the outcome variable is an exit from the particular district panel and the particular specification is as follows:

$$\Pr(exit = 1) = F(\beta_0 + \beta_1 Household\ Size + \beta_2 Khoi + \beta_3 Slaves + \beta_4 HHI + \beta_5 Vines + \beta_6 Cattle + \beta_7 Sheep) \quad (3)$$

where $F(z) = 1 - \exp\{-\exp(z)\}$.

Equation (3) expresses the probability of exiting a particular district's panel as a function of household size. Expectations are that larger household would have been less likely to exit, hence the author expects a negative and significant β_1. For both Khoi labour employed and slaveholdings, the author expects negative coefficients seeing as it would indicate the size of a settler household's agricultural operations. For Stellenbosch, however, the size of slaveholdings is expected to be more significant in explaining geographical persistence than for Graaff Reinet. Households in Graaff Reinet were far less reliant on slave labour compared to those residing in Stellenbosch. The same holds true for Stellenbosh and Khoi labour. β_4 is expected to have a negative and significant coefficient as it represents the diversity of a household's agricultural production base. The more diverse a household's agricultural production, the less likely negative market shocks to any one industry would have been in forcing an agricultural operation failure. β_5 to β_7 are simply the number of vines, cattle and sheep owned by a settler households. Negative coefficients are expected seeing as a larger agricultural estate would have served as incentive for a settler household to persist in a particular district. The author expects vines to be more significant in explaining geographic persistence in Stellenbosch where cattle and sheep would have been more significant in explaining persistence in Graaff Reinet.

2.4 Data

This chapter employs digitised versions of the official tax censuses, the so-called *opgaafrollen*, for two districts of the Cape Colony. The VOC initially instituted these records to determine the amount of tax settler households owed the governing authority, based on their asset

ownership and agricultural output (Fourie and Green, 2018). The period being analysed comprises 1805 until 1829 for Stellenbosch and 1805 until 1828 for Graaff Reinet for 23 years and 22 years respectively – after taking account of missing years.[28] The unlinked 23-year Stellenbosch dataset has 39251 data points compared to the 30371 data points for Graaff Reinet. The records include the names and surnames of the adult members of a household, the number of children, livestock owned, for later years slaveholdings and indentured Khoi labour, vines cultivated, leaguers of wine and brandy distilled, and in most cases, crops sown and reaped.[29] This dataset allows this chapter to analyse both district and household-level socio-economic differences across time. This subsection provides an overview of this dataset.

Given that the records were kept annually, it became necessary to link the records across time employing a string-distance matching algorithm similar to that employed by Rijpma, Cilliers and Fourie (2019).[30] This algorithm relies mainly on first names and surnames of household heads, marriage status, first names and surnames of spouses, initials of both the household and their spouse and vine ownership. Naturally, the inclusion of spouses into the linkage algorithm may lead to bias in the linkage process toward married couples. This is one limitation inherent to the dataset. Observations with more information – such as spouses and vines – would have greater linkage rates compared to observations with less information. In this chapter, where the Graaff Reinet dataset was linked already, the author linked the Stellenbosch dataset across time with 81% of the data points in the full sample returning at least one link. The expected error rate of linkages was also minimised below the 0.5 threshold level.

Table 2-1 exhibits descriptive statistics of three alternative datasets for both districts. The first panel of each district illustrates the descriptive statistics of the full datasets before any linkage. The second panel shows the statistics for the linked *opgaafrollen* dataset, whereas the third panel presents the statistics of the linked *opgaafrollen*-SAF dataset. The third panel dataset consists of only those households for which both a birth year and death year was present. As is clear from the relative small size of each sample there were a substantial number of individuals in the SAF who had only information for a birth year, death year or neither. Only for approximately a sixth of the households in the fully linked *opgaafrollen* were links found in the SAF for which both birth years and death years were available. It is important to have this

[28] When identifying an 'exit' from the district panel, the author takes care not to identify such missing years as 'exits' from either district panel.
[29] Leaguers was a common measuring unit of wine and brandy and equated 153.7 US gallons.
[30] Refer to Appendix C an evaluation of the linkage procedure when applied to the Stellenbosch dataset spanning from 1805 until 1829.

information seeing as it is important to establish the age of the household head and distinguish between those households who died from those that migrated. This is essential in the migration analysis section of this chapter.

As far as the comparisons among the three datasets of both districts are concerned, the descriptive statistics for the fully linked dataset and fully linked *opgaafrollen* dataset are relatively similar. On the other hand, there are differences in the statistics of the limited dataset and the fully linked *opgaafrollen* dataset. This should not be cause for concern, however, as the results for the survival analysis illustrate later on as the significance and magnitude of the coefficients on the survival analysis covariates are comparable between the full and limited datasets. This similarity, even in the context of variable descriptive statistics, serves as robustness check of the comparable results returned by the complementary log-log survival model presented later on.

Table 2-1 Descriptives statistics of selected variables for full and limited samples of Stellenbosch and Graaff Reinet

	Stellenbosch Full Unlinked Dataset									
	Current Year	First Year of Observation	Last Year of Observation	Age	Settlers	Slaves	Khoi	Cattle	Sheep	Vines
Mean	1818	-	-	-	***3	***5	***1	***14	***17	***11147
Median	1819	-	-	-	2	1	0	0	0	0
Minimum	1805	-	-	-	0	0	0	0	0	0
Maximum	1828	-	-	-	58	122	970	652	4000	1250000
Range	23	-	-	-	58	122	970	652	4000	1250000
SD	7.22	-	-	-	2.61	8.95	8.89	31.29	72.24	27909.98
n	39251	-	-	-	39251	39251	39251	39251	39251	39249
	Stellenbosch Full Linked Sample									
	Current Year	First Year of Observation	Last Year of Observation	Age	Settlers	Slaves	Khoi	Cattle	Sheep	Vines
Mean	***1818	***1813	***1822	-	3	5	1	14	17	11926
Median	1819	1812	1825	-	2	1	0	0	0	0
Minimum	1805	1805	1806	-	0	0	0	0	0	0
Maximum	1829	1828	1829	-	19	118	75	652	4000	1250000
Range	24	23	23	-	19	118	75	652	4000	1250000
SD	7.07	7.33	7.42	-	2.61	9.04	2.55	31.33	70.77	28896.41
n	31902	4853	4853	-	31899	31902	31898	31902	31902	31900
	Stellenbosch Limited SAF-Linked Sample									
	Current Year	First Year of Observation	Last Year of Observation	Age	Settlers	Slaves	Khoi	Cattle	Sheep	Vines
Mean	***1819	***1813	***1824	39	***5	***10	***2	***28	***28	***26700
Median	1820	1812	1829	36	4	6	0	16	0	2000
Minimum	1805	1805	1806	16	0	0	0	0	0	0
Maximum	1829	1828	1829	88	17	122	34	414	1420	310000
Range	24	23	23	72	17	122	34	414	1420	310000
SD	6.89	7.54	7.42	12.60	2.58	11.87	3.15	36.90	80.04	37417.46
n	5669	602	602	5669	5669	5669	5669	5669	5669	5669
	Graaff Reinet Full Unlinked Dataset									
	Current Year	First Year of Observation	Last Year of Observation	Age	Settlers	Slaves	Khoi	Cattle	Sheep	Vines
Mean	1817	-	-	-	4	1	4	43	552	319

Median	1817	-	-	-	3	0	1	22	247	0
Minimum	1805	-	-	-	0	0	0	0	0	0
Maximum	1828	-	-	-	15	57	63	1333	14121	148174
Range	23	-	-	-	15	57	63	1333	14121	148174
SD	6.53	-	-	-	2.84	2.98	6.14	62.65	788.92	2321.03
n	30371	-	-	-	30361	30361	30344	30361	30346	30224

Graaff Reinet
Full Linked Sample

	Current Year	First Year of Observation	Last Year of Observation	Age	Settlers	Slaves	Khoi	Cattle	Sheep	Vines
Mean	***1817	***1813	***1822	-	***4	***1	***4	***46	***607	***339
Median	1817	1812	1824	-	4	0	1	25	300	0
Minimum	1805	1805	1806	-	0	0	0	0	0	0
Maximum	1828	1826	1828	-	15	57	63	1333	10120	112935
Range	23	21	22	-	15	57	63	1333	10120	112935
SD	6.32	6.70	6.32	-	2.84	3.10	6.36	64.99	815.42	2233.63
n	25283	3145	3145	-	25283	25283	25269	25283	25270	25167

Graaff Reinet
Limited SAF-Linked Sample

	Current Year	First Year of Observation	Last Year of Observation	Age	Settlers	Slaves	Khoi	Cattle	Sheep	Vines
Mean	***1818	***1815	***1823	34	***5	***2	***5	***69	***877	***553
Median	1819	1814	1826	31	5	0	3	43	600	0
Minimum	1805	1805	1806	16	0	0	0	0	0	0
Maximum	1828	1826	1828	88	15	31	63	1333	7709	53000
Range	23	21	22	72	15	31	63	1333	7709	53000
SD	6.40	7.05	6.30	11.43	2.55	3.51	7.18	77.00	922.04	3071.58
n	5940	804	804	5940	5940	5940	5940	5940	5933	5918

Note: *,**,*** indicate statistically significant differences in means between the two districts at the 10%, 5% and 1% level of significance

As additional overview of the datasets. Table 2-13 in Appendix B compares descriptive statistics for a migrant restricted dataset of both the Stellenbosch and the Graaff Reinet district. Apart from minor differences, the statistics are quite comparable with those presented in Table 2-1. This should validate the unbiasedness of the larger dataset when employed in the survival analysis later on. It is vital for the characteristics of the datasets to be similar in order to circumvent the survival analysis producing biased estimates when conducted for larger and limited samples.

Additionally, Table 2-2 present statistics comparing a migrant limited sample with a larger fully linked sample. The average time observed between the full sample and migrant restricted sample is similar for both districts. This suggests that on average, settlers resided in the districts for an unbiased amount of time. This is significant in the context of modelling migration. In contrast, the proportion of married individuals present in each migrant restricted sample is considerably different from its corresponding full sample. The unbiasedness of the results produced from the survival analysis is therefore questionable in this aspect. Alternatively, it could simply speak to the characteristics of the individuals that elect to migrate. The reader needs to consider this when observing the results of the survival analysis. Nevertheless, as the

results from the survival illustrate in the following section, the survival analysis coefficients remain comparable between the two samples.

Table 2-2 Additional descriptive statistics for migrant restricted samples of either district, 1805-1829

Measure	Full Sample Graaff Reinet	Migrant Limited Sample Graaff Reinet	Full Sample Stellenbosch	Migrant Limited Sample Graaff Reinet
Marriage Count	19154	2459	16176	1746
Total Count	25308	2488	29234	1894
Marriage Percentage	76%	99%	55%	92%
Average Time Observed	6	5	7	7

The major variable of focus in this chapter is the PCA-derived wealth index. This single agricultural wealth metric is calculated using a similar approach as Filmer and Pritchett (2001), McKenzie (2005), Vyas and Kumaranayake (2006) and Krishnan (2010). The approach entails calculating the weighted sum-product of component scores with weighting determined by the variance of each component as a proportion of the total variance. Appendix A provides a more detailed explanation of the estimation strategy. The asset classes used in the PCA to construct the composite wealth index include cattle, sheep, donkeys, goats, wagons, carts, and slaveholdings. All of these asset classes are stock variables and, therefore, reflects the total agricultural wealth accumulated by a settler household across time. For the period under observation, the majority of households recorded in the *opgaafrollen* were farmers or had some stock of agricultural assets. Using the aforementioned agricultural asset classes as a robust indicator of a settler household's overall level of wealth is adequate.

2.5 Results

This section investigates whether changes in agricultural wealth explains household out-migration from a particular district. In other words, this chapter analyses whether opportunities for socioeconomic advancement drives negative selection from a particular district. After a preliminary overview of inequality and graphical agricultural asset ownership comparisons across time for both districts, relative mobility is the first subject of analysis in this section. Transition matrices provide an overview of the extent of individual wealth mobility. This chapter then employs regression analysis to examine unconditional mobility. To control for other factors affecting changes in wealth, this section estimates conditional mobility models, which include additional covariates. The second subsection provides survival analysis estimates. Finally, the analysis estimates the micro-convergence model again; however, the

model is conditioned on constructed hazard rates. The estimation strategy informs whether settlers that were more or less likely to leave either district were the ones that exhibited the least or greatest level of convergence.

2.5.1 Preliminary overview of inequality in the Cape Colony

The Cape Colony was an unequal society with a few households possessing most of the wealth (Fourie and von Fintel, 2010; Fourie and von Fintel, 2011). Figure 2-1 illustrates calculated gini coefficients with the Jasso-Deaton formula (Jasso, 1979). The gini coefficients were calculated annually on the total number of observations available for each year for both districts. Table 2-3 illustrates the annual population sizes, or the number of households, used to calculate the gini coefficients plotted in Figure 2-1 and the average asset agricultural ownership plotted in Figure 2-2. While Stellenbosch exhibited a marginal increase in the number of households captured in the *opgaafrollen*, Graaff Reinet nearly doubled the number of people residing in the district over the course of three decades. This remarkable increase in population speaks to the relative appeal of Graaff Reinet compared to Stellenbosch for migrants with no other options as far as subsistence was concerned. This chapter is concerned with determining the underlying cause of this appeal.

From the historical overview provided in Section 2.2, the sample period provides a unique case study to examine the effects of more liberal, market-friendly policies on a pre-industrial, slave-driven, and largely agrarian economy.

Apart from those mentioned in the historical overview, other legislative changes specifically relating to the frontier region included the amendments to Khoi conscription in 1807. Livestock farmers at the frontier (Neumark, 1957:115) employed young, capable Khoi men, instead of these men serving in the military. In 1812 the intention was made clear by Governor John Cradock to pursue significant settlement establishment along the southern East Coast of the Colony. Certain tracts of land in this region were even to be reoccupied on perpetual quitrent terms by settlers after expulsion of the native Xhosa tribes. Another significant legislative change in 1807 was the abolishment of the trans-Atlantic slave trade. The government no longer permitted settler households to import slaves into Colony aboard British vessels. In the slave-driven economy of the Cape, this would have affected settlers' ability to accumulate agricultural wealth.

Figure 2-1 indicates that the frontier district of Graaff Reinet was less unequal than the established viticulture intensive district of Stellenbosch. Inequality in Graaff Reinet grew

marginally over time, however. This finding is similar to that of Kearl, Pope and Wimmer (1980) for the US. High inequality in the more mature, arable farmer region of Stellenbosch supports an argument that individuals without capital, found it difficult to compete with the existing elite (Fourie and von Fintel, 2012). In contrast, low capital requirements for starting livestock operations at the frontier, allowed relatively poorer individuals to achieve success. These low capital requirements, therefore, contributed to a more equal wealth distribution (Neumark, 1957:37). The geographic expansion in the Colony is a testament to the ease with which settlers were able to break into the pastoral farming industry. The more egalitarian district of Graaff Reinet could further serve as preliminary corroboration that negative selection was possible in the Cape. Borjas (1987) argued that negative selection is more likely if the originating society is highly unequal.

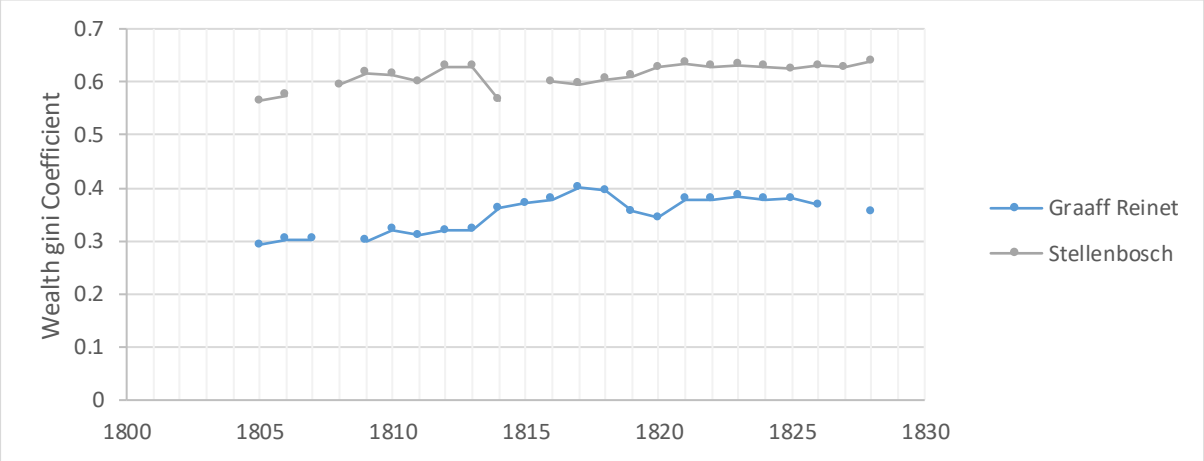

Figure 2-1 Annual gini coefficients of two Cape Colony districts

Table 2-3 Sample sizes for gini coefficient and mean asset ownership calculations

	Sample Size	
Year	Graaff Reinet	Stellenbosch
1805	674	1193
1806	757	1172
1807	848	-
1808	-	1169
1809	1043	1245
1810	1191	1314
1811	1310	1330
1812	1436	1109
1813	1391	1160
1814	958	1233
1815	1020	-
1816	1153	1260
1817	1347	1343
1818	1315	1467
1819	1043	1467

1820	1104	1482
1821	1170	1475
1822	1237	1644
1823	1329	1639
1824	1327	1650
1825	1319	1602
1826	1321	1574
1827	-	1578
1828	1017	1625
1829	-	1631

Consistent with more contemporary research (Du Plessis and Du Plessis, 2012; Fourie and Uys, 2012; Fourie, 2013), the region in the immediate vicinity of the Cape, which would include Stellenbosch, had unequally distributed agricultural wealth. The extent of this inequality is apparent from Figure 2-1. Guelke (1976) also suggested such inequality for the Cape. In contrast, the wealth distribution in livestock farming regions was far less unequal. The consistently high gini in the Stellenbosch district suggests that most of the agricultural wealth was in the possession of a few households. Failing arable farmers may have perpetuated the high inequality by selling their estates to their nearest neighbour upon failure. After they sold their estate, they would have migrated to the frontier (Macmillan, 1929:24). If the aforementioned occurred frequently enough, it would eventually have led to the establishment of an entrenched elite class that could effectively crowd out struggling farmers and later-arriving settlers. The capital that these migrating colonists acquired from liquidating their estate – however small – would then have been used for their livestock farming start-up costs. Given land being a limited resource and the main operation in Stellenbosch being viticulture, one would expect that poorer, late-arriving households were not able to acquire substantially large tracts of land to manage profitable viticulture or crop farming operations.[31] Graaff Reinet, had lower wealth inequality. At the frontier, capital requirements to acquire land and set-up a livestock farming operation were low (Guelke, 1976). It is therefore probable that settlers with little capital and no other options for a livelihood perceived the frontier as a place of

[31] In this chapter these households referred to were only arriving at the Cape during the latter part of the eighteenth century. This specific year is arbitrary, but at this stage the district of Stellenbosch – which, along with Graaff Reinet is the subject of analysis in this chapter – has already existed for at least seventy years, since its establishment in 1679. It is, therefore, conceivable that sufficient time had surpassed for settlers to occupy the most fertile land, particularly if 1700 marked the year of the commencement of rapid eastward expansion (De Kock, 1924:18). According to Guelke (1976), a lack of sufficient capital among settlers in arable farming regions in the vicinity of the Cape, induced prospective farmers to substitute a factor of production in short supply (capital) with one that was relatively plentiful (land), compared to other factors of production. In the absence of sufficient capital, colonists that arrived early enough, settled on vast tracts of land. Consequently, late-arrivals without sufficient capital would have been forced to settle further inland if they wanted to start farming ventures or take up trades. Therefore, only those households that initially obtained a large enough tract of land were able to successfully start and manage a profitable arable farming operation.

opportunity. According to Neumark (1957:35), a decline in the economic conditions in and around the Cape was a major driver for migration towards the frontier.

Figure 2-2 provides a preliminary overview of district level differences in macroeconomic variables. Household sizes in the Stellenbosch district were smaller than on the frontier. A possible explanation for this is that households in Stellenbosch tended to have older household heads, with fewer children younger than sixteen, as recorded in the *opgaafrollen*. Alternatively, Walker (1941:91) notes that it was common practice among the interior pastoralists to live as one large family group on the paternal farm, until growing herds of livestock forced family members to relocate.

Graaff Reinet could have simply played host to younger family units. The 'age' column for the third panels of descriptive statistics of Table 2-1 confirm this. Both the average, median and maximum ages are greater for Stellenbosch than for Graaff Reinet. Households in Graaff Reinet, additionally, on average had one additional child compared to Stellenbosch for the sample period. Conventionally, new immigrants to the Cape settled in the region of the Cape Peninsula, while younger settlers born in the Cape ventured beyond the mountain ranges (Theal, 1915:61).

Slaves were the preferred labour input in Stellenbosch as opposed to Khoi labour in Graaff Reinet. The greater economies of scale present in the viticulture industry is the cause of this and is consistent with the qualitative accounts of Walker (1941:83). Wine was the major economic output in Stellenbosch. Livestock farming, in contrast, featured more prominently in Graaff Reinet. Households migrating to Graaff Reinet generally did not have enough capital to afford slaveholdings or had to sell what few assets they had in the more mature districts to acquire capital for a livestock farming start-up (Neumark, 1957).

The final two rows of charts in each column depict the major productive operations present in the two districts. Livestock farming was the most important agricultural function in Graaff Reinet. Households in Stellenbosch, on the other hand, owned a larger number of vines, whereas in Graaff Reinet the average vines owned per household was virtually zero. According to Theal (1915:60), the land on the coastal belt was "adapted for cultivation … the ideas of the people favoured the plough … inhabitants of that part of the country depend upon their crops … and keep no more oxen and sheep than are required for their own use". The mountainous regions at the frontier were more suited for livestock farming than for vineyards, since these regions were dry and less fertile (Walker, 1941:90).

Having conducted two sample t-tests to determine if the differences in means for each asset class of either district is statistically significant from zero leads to rejection of the null hypothesis at 5% level of significance for each year during which each district had observations. The differences in the means of the various asset classes between the two districts are, therefore, statistically different from zero.

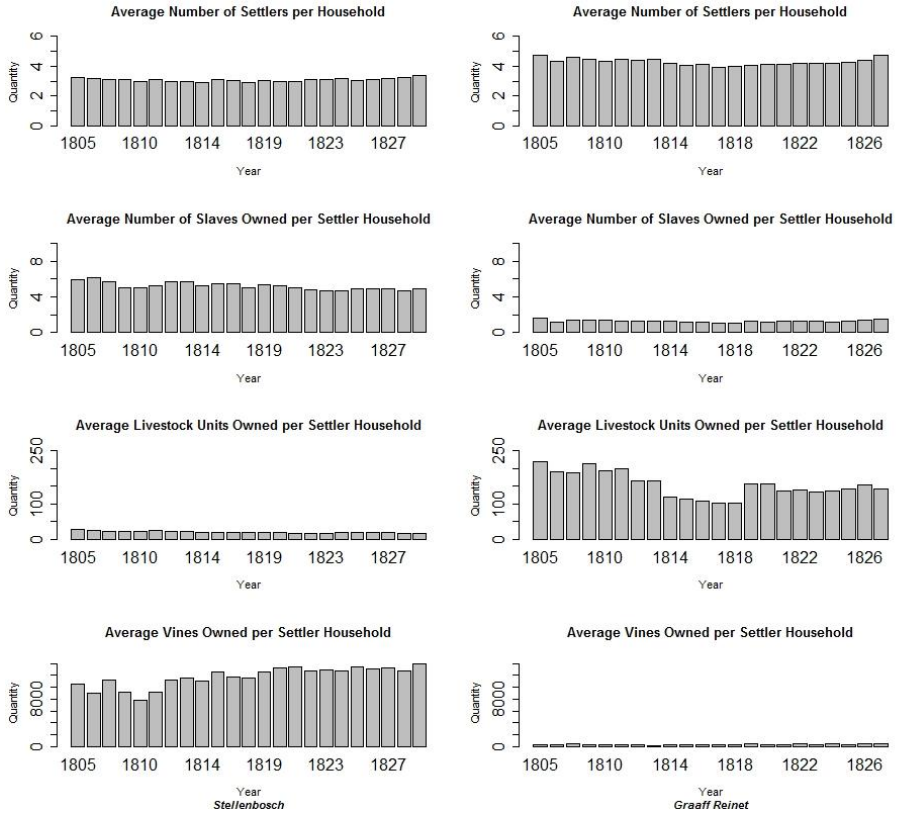

Figure 2-2 Average quantity of selected variables per settler household for the Stellenbosch and Graaff Reinet districts, 1805 to 1829

2.5.2 Relative mobility

Transition matrices are useful to examine relative mobility. The panel dataset allows for an evolutionary perspective of district wealth distribution. Tables 2-4 and 2-5 present the transition matrices of the Stellenbosch and Graaff Reinet districts, respectively.

The transition matrices use wealth quintiles to illustrate the relative movement in society's socioeconomic status (SES) ladder. The relative mobility analysis employs the PCA-generated composite wealth index to calculate annual quintiles. The calculation involves ordering the wealth indices in ascending order and dividing the ordered dataset into five equally sized quantiles. The author then assigns a value ranging from one to five depending on which quintile a household's specific annual wealth index places them in the ordered wealth index dataset.

The next step involves comparing households' base year quintiles (relative to other households) to their assigned quintiles in the subsequent year. The number of households in one specific quintile in the base year are then expressed as proportions of the total number of households in a particular quintile in the subsequent year.

Table 2-4 validates *a priori* expectations concerning Stellenbosch's stability. There were no substantial improvements in households' relative wealth status. The most upwardly mobile periods are the earlier five-year windows: 1805 to 1809 and 1809 to 1814. During these periods, a considerable number of households were able to improve their relative level of wealth. For example, the proportion of quintile 1 households in the initial year moving into wealth quintile 3 in the subsequent year was 15% for 1805 to 1809, and 22% for 1809 to 1814, respectively. In the later periods, it became more difficult to advance into the highest wealth quintile in Stellenbosch. A mere 23% of those households in wealth quintile 4 in 1819 were in quintile 5 in 1824. This could represent the emergence of an elite class in Stellenbosch. In general, inertia was prevalent in the period from 1819 to 1824, suggesting that later on it was challenging for households to change their wealth position.

Table 2-4 Transition matrix for Stellenbosch presenting household changes across wealth quintiles

Stellenbosch							
		1809					
	Quintile	1	2	3	4	5	Total
1805	1	51%	21%	**15%**	10%	3%	100%
	2	20%	24%	35%	22%	0%	100%
	3	6%	4%	41%	40%	10%	100%
	4	2%	2%	6%	44%	46%	100%
	5	3%	1%	1%	10%	86%	100%
		1814					
	Quintile	1	2	3	4	5	Total
1809	1	42%	21%	**22%**	12%	3%	100%
	2	15%	59%	15%	11%	0%	100%
	3	12%	16%	36%	23%	12%	100%
	4	5%	4%	15%	47%	30%	100%
	5	1%	1%	6%	15%	77%	100%
		1819					
	Quintile	1	2	3	4	5	Total
1814	1	46%	24%	22%	7%	2%	100%
	2	12%	22%	49%	14%	2%	100%
	3	9%	10%	38%	38%	6%	100%
	4	3%	1%	18%	45%	32%	100%
	5	1%	1%	3%	15%	80%	100%
		1824					
	Quintile	1	2	3	4	5	Total
1819	1	60%	20%	15%	3%	2%	100%
	2	17%	33%	33%	17%	1%	100%

	3	7%	7%	56%	24%	6%	100%
	4	3%	2%	8%	64%	23%	100%
	5	0%	1%	2%	8%	90%	100%

Table 2-5 is the transition matrix for Graaff Reinet. In the earlier years, the largest movements were from the lowest to the mid-tier wealth quintiles and from the mid-tier wealth households to wealth quintile 4. In terms of mobility among the top-tier wealth quintiles, there is consistently greater movement across all periods compared to Stellenbosch. For example, the proportion of households in wealth quintile 4 in the initial year that eventually ended up in the highest quintile, are consistently larger in Graaff Reinet. In later periods the proportion of households are not only concentrated among the mid and lower tier quintiles, but there are also instances in which some households showed significant leaps in wealth quintiles. The proportion of households reported as being in wealth quintile 3 initially, and quintile 5 in the subsequent period, are consistently larger compared to Stellenbosch. Mid-tier wealth households in Graaff Reinet are more likely to have exhibited relative mobility in the later years of the observation period.

Table 2-5 Transition matrix for Graaff Reinet presenting household changes across wealth quintiles

Graaff Reinet							
		1809					
	Quintile	1	2	3	4	5	Total
1805	1	34%	43%	17%	5%	0%	100%
	2	2%	29%	54%	15%	0%	100%
	3	1%	1%	38%	55%	6%	100%
	4	1%	0%	2%	45%	53%	100%
	5	1%	1%	0%	4%	94%	100%
		1814					
	Quintile	1	2	3	4	5	Total
1809	1	29%	36%	30%	5%	0%	100%
	2	12%	25%	37%	24%	3%	100%
	3	4%	8%	30%	48%	10%	100%
	4	1%	7%	9%	36%	48%	100%
	5	0%	3%	2%	6%	88%	100%
		1819					
	Quintile	1	2	3	4	5	Total
1814	1	42%	33%	16%	8%	1%	100%
	2	9%	31%	29%	23%	7%	100%
	3	4%	16%	30%	38%	11%	100%
	4	1%	4%	24%	37%	33%	100%
	5	0%	1%	2%	20%	77%	100%
		1824					
	Quintile	1	2	3	4	5	Total
1819	1	40%	36%	16%	3%	5%	100%
	2	12%	41%	35%	10%	2%	100%
	3	2%	12%	43%	32%	10%	100%

	4	1%	2%	12%	50%	35%	100%
	5	1%	1%	3%	18%	77%	100%

From these relative mobility tables, economic opportunity existed in Graaff Reinet during the earlier years of the sample period. Relative upward mobility in Stellenbosch was less prominent. Relative mobility in Graaff Reinet decreased with time, however. This matches results in Figure 2-1 where inequality started to increase. Increasing inequality and declining relative mobility are both indicators of the frontier starting to close. Giliomee (1982:320) argues that the frontier's closure was not uniform among different areas and ethnic groups. However, 1812 marked the year during which the frontier closed for all population groups. Table 2-5 confirms this position from a relative wealth mobility standpoint for Graaff Reinet.

2.5.3 Absolute mobility

This subsection firstly presents output from an unconditional mobility model. Unconditional mobility models are univariate regression models with the starting wealth value as the only regressor. The methodology estimates the model over a five-year rolling window for both districts. The following step involves plotting the estimated β_1 coefficients to simplify district comparisons.

Figure 2-3 confirms conclusions drawn from the transition matrices. There is some opportunity for socio-economic advancement for poorer households living in both districts during certain periods. The initial starting wealth index generally has a negative impact on wealth changes – particularly in earlier periods. This result implies that the greater a household's starting wealth, the less the change in the household's wealth index was. Poorer households are, therefore, able to catch up with their wealthier peers. In Stellenbosch, the speed of convergence over a five-year period is quicker during earlier periods. Every five years, approximately 20% of the agricultural wealth gap between the wealthiest and poorest households is eliminated from 1810 until 1817. This speed of convergence implies that the half-life of the wealth gap between the poorest and wealthiest households is 15.5 years. In other words, every 15.5 years approximately half of the agricultural wealth gap is eliminated. Convergence slows after 1817 and divergence emerges until the late 1820s. Graaff Reinet tends to be slightly more mobile in later periods, although quite similar to Stellenbosch earlier on. These findings are consistent with Stewart (2009) that confirms greater opportunity for economic advancement at the US agricultural frontier, compared to urban areas. Mobility in Graaff Reinet, however, was by no means significantly greater than in Stellenbosch. Convergence even dissipates slightly with time

during the middle years of the observation period before accelerating marginally during the later years.

Authorities reduced customs duties on wines exported to Europe between 1812 and 1825 considerably (Neumark, 1957:32). This trade concession resulted in large viticulturists flourishing. The boom in the Cape wine industry caused considerable increases in vineyards. Wine farmers with large estates stood to benefit from the economies of scale inherent to the slave-driven wine industry in the Stellenbosch district. The trade concessions along with the economies of scale and extensive farming practices, explain the considerable decreases in unconditional convergence, and even divergence at some points. Benefits from the lower customs duties were unequally distributed.

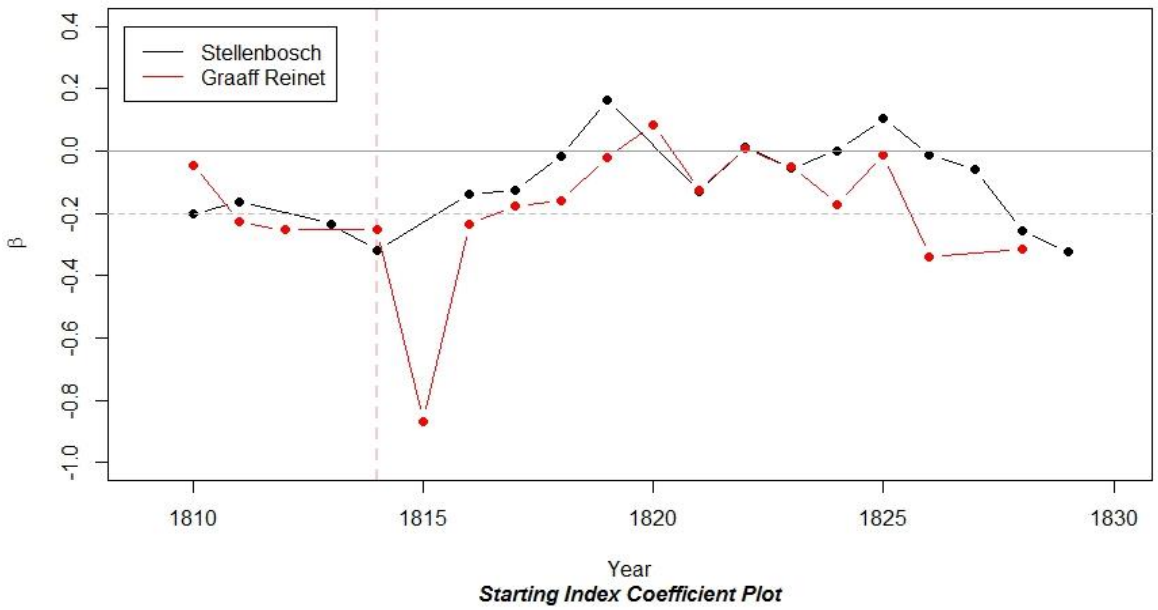

Figure 2-3 Rolling five year mobility estimates for two Cape Colony districts, 1810 to 1829

In Figure 2-3, the sudden trough at 1815 for Graaff Reinet can be attributed to the fourth frontier war that took place in 1811 and 1812. Livestock raids during frontier wars often led to substantial losses of livestock among pastoralists located in the region (Neumark, 1957:111,118-120). Given that the base year for 1815 is 1810, the war could have inflated the estimated convergence during this period. Less wealthy households suddenly became more equal to previously wealthy households with the loss of livestock that occurred during the war.

Figure 2-3 illustrates a gradual decline in unconditional mobility for both districts after 1815. The author attributes the decline in Stellenbosch mobility to wine farmers benefiting from relaxed wine export duties. In Graaff Reinet the decline in mobility, confirm the position of

Giliomee (1982) that the frontier closed completely in 1812. With the British government declaring its control over the region, decreasing land availability with population increases, and stock raids being less frequent, it created an environment in which well-off livestock farmers started to outpace their less-wealthy counterparts. Cilliers and Green (2018) prove that the frontier closure in Graaff Reinet was characterised by poorer households having more household members for labour input, while the wealthiest households developed more capital-intensive farming methods to obtain greater market access for their produce. This explains both the decreasing mobility and increasing inequality in the years following the frontier closure.

Graaff Reinet was not a speculative society. The difference in unconditional mobility between Stellenbosch and Graaff Reinet was too small to validate this theory. Instead, the district was a safe haven or safety-valve society for those settler households who had no other options for sustaining a livelihood.[32] This is consistent with Guelke's (1976) arguments suggesting that settlers were not driven by an excess return motive in their migratory decisions. They migrated from the more established regions of the Colony to the frontier when forced by economic circumstances to do so. In other words, Graaff Reinet was a district that absorbed the excess numbers of people from the more established districts that were unable to be successful in the winemaking and arable farming industry of Stellenbosch. In contrast to Neumark's (1957) position, Graaff Reinet did not offer significantly greater opportunities for poorer households to accumulate wealth and converge on their wealthier peers. The opportunities that were present, though, provided sufficient incentive for households to settle at the frontier. Settler households were negatively selected from other parts of the Colony to the frontier in the absence of adequate prospects for socioeconomic advancement in the originating districts – which could include Stellenbosch. Subsequent to the unconditional mobility estimates, it is necessary to expand the analysis and consider conditional mobility. Estimating conditional mobility controls for other potential factors affecting wealth accumulation.

Tables 2-6 and 2-7 present results for the conditional mobility estimates. The speed of convergence in agricultural wealth between the wealthiest and poorest households is relatively quickly over the five-year window. For Stellenbosch, after having controlled for household level differences, the speed of convergence increased markedly. In the earlier years of the observation period until 1817, at least 30% of wealth gap between the wealthiest and poorest households is eliminated every five years. After this until the late 1820s, the speed of

[32] Kearl, Pope and Wimmer (1980); Hall and Ruggles (2004)

convergence decreases before reaching pre-1817 levels again. The results are similar for Graaff Reinet. Before 1817, the speed of convergence is quicker where, apart from 1810, at least 30% of the wealth gap is eliminated every five years. This means that the expected half-life of the wealth gap between the poorest and wealthiest households is at most 9.7 years. Twenty-seven per cent of the wealth gap is eliminated for the five-year period ending in 1817 – a half-life of eleven years. At the end of the observation period, the speed of convergence exhibits levels quicker than that witnessed pre-1817. The fact that conditional mobility is greater than unconditional mobility proves that unique household level characteristics are significant in explaining opportunities for socioeconomic advancement of poorer households.

The covariates included in these conditional mobility regressions are the starting wealth index value, the preferred labour input, the production diversity index, and household size.[33] Diversity of production – which is the Herfindahl-Hirschman Index (HHI) (Du Plessis, Jansen and von Fintel, 2015) – has an expected positive relationship over most years.

Table 2-6 Rolling five-year conditional mobility estimates for Stellenbosch district, 1810 to 1829

	Δy1810	**Δy1811**	**Δy1813**	**Δy1814**	**Δy1816**	**Δy1817**	**Δy1818**	**Δy1819**	
Starting Wealth Index	-0.46***	-0.37***	-0.43***	-0.49***	-0.32***	-0.32***	-0.22***	-0.08**	
	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	
ln(Production Diversity)	0.54***	0.48***	0.56***	0.43***	0.46***	0.50***	0.45***	0.44**	
	(0.05)	(0.04)	(0.04)	(0.04)	(0.04)	(0.05)	(0.03)	(0.04)	
Labour Input (Equal)	-0.01	0.08	0.00	-0.01	-0.14	0.03	0.00	-0.03	
	(0.11)	(0.08)	(0.08)	(0.07)	(0.09)	(0.07)	(0.05)	(0.05)	
Labour Input (Khoi)	-0.02	-0.00	-0.00	-0.07	-0.05	-0.02	-0.04	0.02	
	(0.05)	(0.04)	(0.05)	(0.04)	(0.05)	(0.04)	(0.03)	(0.03)	
Labour Input (Slaves)	0.09**	0.06*	0.05	0.02	0.02	0.08**	0.06**	0.07**	
	(0.03)	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)	
Household Size	0.00	0.01*	0.00	0.00	0.01*	-0.01	-0.01	0.00	
	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
Intercept	-0.03	-0.05**	-0.03	0.02	-0.03	-0.00	0.00	-0.05**	
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.00)	
R^2	0.30	0.34	0.43	0.48	0.28	0.26	0.28	0.31	
Observations	547	546	531	563	591	584	618	625	
	Δy1821	**Δy1822**	**Δy1823**	**Δy1824**	**Δy1825**	**Δy1826**	**Δy1827**	**Δy1828**	**Δy1829**
Starting Wealth Index	-0.29***	-0.18***	-0.23***	-0.15***	-0.06*	-0.15**	-0.20***	-0.43***	-0.50***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
ln(Production Diversity)	0.47***	0.39***	0.44***	0.36***	0.48***	0.38***	0.43***	0.49***	0.51***
	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)
Labour Input (Equal)	0.05	0.07	0.04	-0.05	0.03	-0.03	-0.05	-0.06	0.05
	(0.05)	(0.06)	(0.04)	(0.06)	(0.08)	(0.06)	(0.05)	(0.05)	(0.07)
Labour Input (Khoi)	0.02	-0.03	-0.07*	-0.02	-0.04	-0.03	-0.02	-0.06*	-0.10**
	(0.04)	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)
Labour Input (Slaves)	0.09***	0.03	0.02	0.01	-0.00	0.01	0.03	0.09***	0.09***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
Household Size	0.00	-0.00	-0.00	-0.00	-0.01	-0.00	-0.01**	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Intercept	-0.01	-0.01	-0.01	-0.00	-0.00	-0.01	-0.01	-0.02	-0.02
	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
R^2	0.25	0.18	0.20	0.12	0.16	0.15	0.22	0.41	0.49
Observations	659	763	805	815	832	839	900	938	992

Note: *** p < 0.001, **p < 0.01, * p < 0.05
Standard errors in parentheses

[33] Netting (1982) notes that there is a historical precedent where agricultural wealth is positively associated with household size.

Table 2-7 Rolling five-year conditional mobility estimates for Graaff Reinet district, 1810 to 1828

	Δy1810	**Δy1811**	**Δy1812**	**Δy1814**	**Δy1815**	**Δy1816**	**Δy1817**	**Δy1818**	**Δy1819**
Starting Wealth Index	-0.11***	-0.36***	-0.37***	-0.34***	-0.91***	-0.32***	-0.27***	-0.24***	-0.16***
	(0.02)	(0.03)	(0.03)	(0.03)	(0.01)	(0.02)	(0.02)	(0.02)	(0.03)
ln(Production Diversity)	0.20***	0.48***	0.41***	0.34***	0.54***	0.23***	0.28***	0.24***	0.51***
	(0.04)	(0.05)	(0.05)	(0.06)	(0.05)	(0.04)	(0.03)	(0.05)	(0.04)
Labour Input (Equal)	0.35**	0.29*	0.25	-0.37**	0.26*	0.14	0.09	0.11	0.59***
	(0.12)	(0.14)	(0.14)	(0.14)	(0.12)	(0.10)	(0.13)	(0.12)	(0.16)
Labour Input (Khoi)	0.04	0.12***	0.08*	0.00	0.20***	0.03	0.01	0.02	0.05
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)
Labour Input (Slaves)	0.08*	0.27***	0.18***	0.02	0.25***	0.08*	0.05	0.03	0.09*
	(0.04)	(0.05)	(0.04)	(0.04)	(0.05)	(0.04)	(0.03)	(0.03)	(0.04)
Household Size	0.01**	0.02***	0.01***	0.01*	0.01*	0.01	0.01*	0.01*	0.01*
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)
Intercept	-0.01	-0.05	-0.01	-0.00	-0.01	-0.03	-0.03	0.02	-0.08**
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)
R^2	0.09	0.29	0.28	0.24	0.87	0.19	0.17	0.14	0.23
Observations	547	612	673	494	563	654	757	767	590
	Δy1820	**Δy1821**	**Δy1822**	**Δy1823**	**Δy1824**	**Δy1825**	**Δy1826**	**Δy1828**	
Starting Wealth Index	-0.03	-0.26***	-0.10**	-0.15***	-0.27***	-0.14*	-0.45***	-0.43***	
	(0.03)	(0.05)	(0.03)	(0.03)	(0.02)	(0.06)	(0.04)	(0.02)	
ln(Production Diversity)	0.37***	0.48***	0.37***	0.33***	0.37***	0.46***	0.36***	0.34***	
	(0.04)	(0.08)	(0.04)	(0.05)	(0.04)	(0.10)	(0.09)	(0.04)	
Labour Input (Equal)	-0.07	-0.02	0.12	0.07	0.88***	-0.04	0.17	0.23	
	(0.12)	(0.22)	(0.10)	(0.22)	(0.26)	(0.45)	(0.23)	(0.26)	
Labour Input (Khoi)	0.08**	0.10*	0.09***	0.11***	0.03	0.08	0.08	0.09***	
	(0.03)	(0.04)	(0.03)	(0.03)	(0.02)	(0.06)	(0.05)	(0.02)	
Labour Input (Slaves)	-0.00	-0.01	-0.04	0.07	-0.03	0.05	0.37***	0.18***	
	(0.04)	(0.07)	(0.04)	(0.04)	(0.03)	(0.08)	(0.07)	(0.03)	
Household Size	0.01*	0.01	0.01*	0.01**	0.01***	0.02*	0.02**	0.01***	
	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	
Intercept	-0.03	0.01	-0.02	-0.07*	-0.03	-0.10	-0.05	-0.03	
	(0.03)	(0.05)	(0.03)	(0.03)	(0.02)	(0.06)	(0.05)	(0.02)	
R^2	0.17	0.08	0.13	0.12	0.21	0.04	0.18	0.36	
Observations	616	681	752	732	778	747	779	730	

Note: *** p < 0.001, **p < 0.01, * p < 0.05
Standard errors in parentheses

Households hedged against negative shocks that affected a particular output, show larger positive changes in their wealth.[34] The dummy variables of major labour input categories generally confirm expectations. Stellenbosch households of which the majority employed slave labour, showed the biggest positive changes in wealth relative to households preferring household members as major labour input. This is indicative of the ability of slave owners to realise positive economies of scale inherent to slave labour in arable farming, or indeed the benefits from using slaveholdings as capital (Links, Fourie and Green, 2018; Martins, 2019). Larger households in Graaff Reinet feature more prominently among households that show positive changes in their wealth in most years. The opposite is true for Stellenbosch. Household size does not have a significant impact on the size of wealth changes.

Table 2-7 presents the conditional mobility estimates for Graaff Reinet. Results for household labour preference are similar to those reported for Stellenbosch. In Graaff Reinet, households

[34] Here the term "hedged" is used to refer to households that had a broad production base in that they were actively producing several agricultural outputs. In other words, they would not have been as affected by negative circumstance influencing the market conditions of any one particular output.

with greater production diversity, exhibited greater positive wealth changes. After controlling for additional covariates, the size of the mobility coefficients are marginally greater (conditional convergence in Graaff Reinet is greater than unconditional convergence).

2.5.4 Survival analysis

This subsection presents the results from the survival analysis. In this chapter, survival analysis models the determinants of settlers leaving the two districts. It was noted earlier that the Cape Colony was characterised by significant migratory movements (Fourie, 2013). Inter-district movements of households were prevalent – particularly on the frontier.

This subsection firstly estimates Cox proportional-hazards models and then plots survival curves from the results. These plots provides a preliminary overview of the survival characteristics of each district's households. Figures 2-4 and 2-5 present these plots.

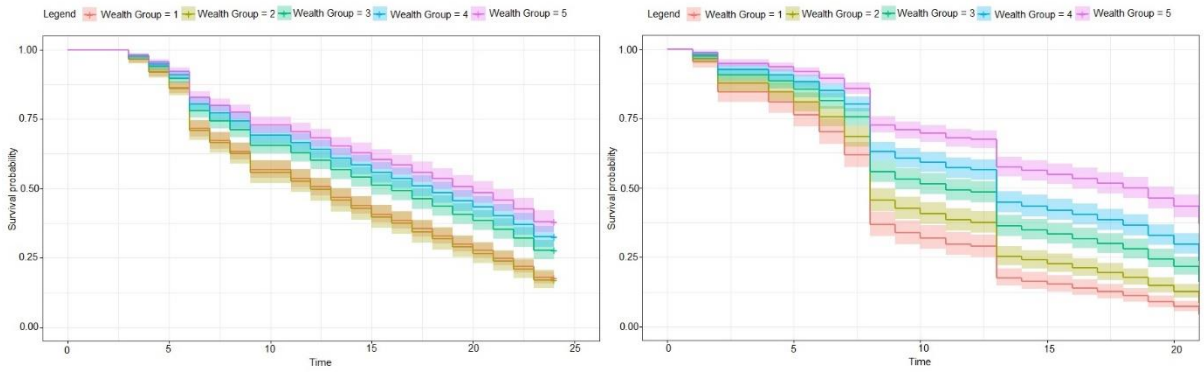

Figure 2-4 Survival curves for Stellenbosch (left) and Graaff Reinet (right) conditioned on the wealth index quintile in the year before exit

The preliminary survival analysis results suggest marginal differences between the Stellenbosch and Graaff Reinet districts. Figure 2-4 shows that settlers in either district, who are in the highest wealth quintile, are likely to 'survive' the longest in the district. For both districts, survival probabilities are similar across all wealth quintiles. The difference among households of different wealth quintiles' likelihood to survive in a particular district is larger for Graaff Reinet. Households from the poorest wealth quintiles in this district were most likely to exit compared to the wealthier quintiles. Households from the poorest wealth quintiles in Stellenbosch were more likely to persist for longer compared to households from the same wealth quintile in the Graaff Reinet district. Stellenbosch survival probabilities were more alike among different wealth quintiles in comparison with Graaff Reinet. This finding is expected. The frontier experienced several skirmishes and wars during the early nineteenth century.

Findings, therefore, confirm that the frontier was the more volatile society.Wealth had a significant role to play in determining a household's persistence.

In Stellenbosch, differences in the level of agricultural wealth of a settler household is a less important factor in determining survival. For Graaff Reinet, in contrast, these differences are more significant. Legassick (1982:295) notes that the Northern frontier of the colony was characterised mostly by hunting, trading and plundering. Concerning the more turbulent Eastern frontier where Graaff Reinet was located, Giliomee (1982) holds a similar position. The Eastern frontier was a place that initially had no definitive borders and different ethnic groups disputed the right of occupation in this region. Borders were determined through violence. The region frequently faced social unrest. Skirmishes and wars often took place in order to legitimise any particular group's claim to the region. Upon the establishment of Graaff Reinet in 1786, it resulted in only a slight increase in the VOC's governing authority at the frontier.

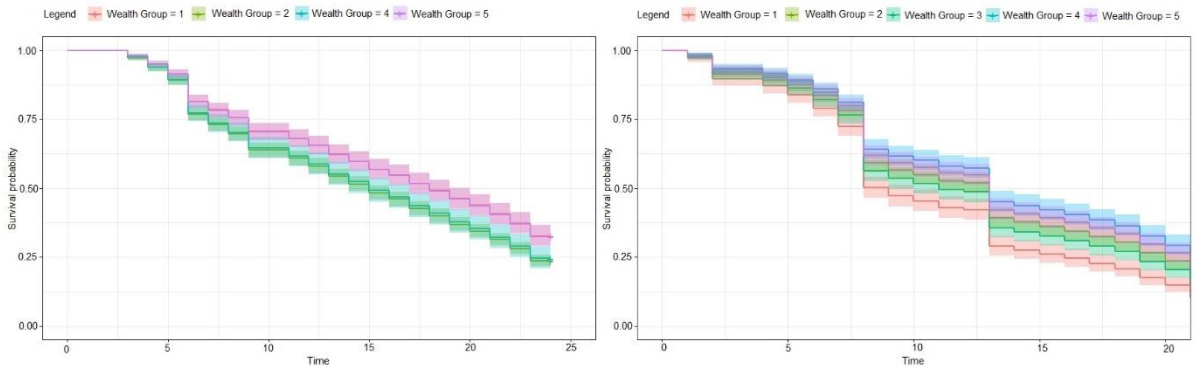

Figure 2-5 Survival curves for Stellenbosch (left) and Graaff Reinet (right) conditioned on the wealth index change quintile in the year before exit

In Figure 2-5, the survival curves are conditioned on the change in a household's wealth index between the year right before exit and two years prior to that. In Stellenbosch, there is not a big difference in the probability to exit the district based on changes in their wealth index. In line with *a priori* expectations, households that show the biggest positive changes in their household wealth prior to their exit, are the most likely to persist in the district for a longer period of time. Results for Graaff Reinet, on the other hand, are marginally different. The differences among the various wealth quintiles' likelihoods to survive are more apparent. Households exhibiting the least positive (most negative) changes in their wealth before their 'exit' were more likely to exit than the rest of the households.

In summary, households in both districts with the least positive changes in their wealth prior to their 'exit' were more likely to drop out of the district. Districts in which arable farming was the dominant economic function would have been exclusionary. Once settled, households had little motivation to move elsewhere, especially during the latter half of the observation period given the more secure *de jure* property rights (although disputed), employment of slave labour, social stability for households with sizable estates and macroeconomic conditions such as trade concessions, benefiting mainly the already wealthy. Struggling crop farmers and viticulturists who opted to migrate to the frontier would acquire the capital needed by selling their land and other operational capital to their neighbours (Neumark, 1957:36-37). In contrast to Neumark's (1957) arguments, the results until now do not yield evidence of the frontier offering significant opportunities for abnormal agricultural wealth accumulation. In line with Guelke (1976), it was a region absorbing excess settlers who failed in crops and viticulture, or did not have enough capital for an arable farming start-up.

The next step involves generating predicted hazard rates from a complementary log-log survival model. The dependent variable in this model is a binary variable adopting values of one at the year of exiting the panel, and zero otherwise.[35]

The survival models include several covariates: household size, Khoi labour in employ, slaveholdings, production diversity, and the logarithm of various agricultural asset quantities. Year dummies are included in order to control potentially turbulent macroeconomic periods in the Colony. Table 2-8 presents the results for both Stellenbosch and Graaff Reinet.

Table 2-8 Complementary log-log survival model for Graaff Reinet and Stellenbosch with expanded sample

Variables	**Graaff Reinet**	**Stellenbosch**
Household Size	-0.17***	-0.24***
	(0.00)	(0.00)
Khoi Labour	-0.02	-0.02
	(0.48)	(0.60)
Slaves Owned	-0.03	-0.13***
	(0.57)	(0.00)
HHI (Production Diversity)	-1.20***	-0.08
	(0.00)	(0.56)
Vines Owned	0.01	-0.05***
	(0.54)	(0.00)
Cattle Owned	0.02	0.00
	(0.49)	(0.93)
Sheep Owned	-0.04***	0.12***
	(0.00)	(0.00)
Constant	-4.57***	-1.20***
	(0.45)	(0.06)
Year Controls	Yes	Yes
Number of Data Points	25309	31903
Number of Unique Households	3170	4853
Number of Events	2156	3239

[35] 'Exit' is defined in the study at hand as dropping out of the district panel without reappearing again.

Note: *** p < 0.001, **p < 0.01, * p < 0.05
Standard errors in parenthesis

The results presented in Table 2-8 are consistent with expectations. Larger households are more likely to 'survive' in each district panel. Sandefur and Scott (1981), in their analysis of household characteristics and migration in the US, suggest that there are greater economic costs associated with migrating for larger households. Additionally, more household members suggest a more challenging withdrawal from their community, societal, or economic participation at the place of origin as well as a more difficult renegotiation for these various roles at the destination.

As expected, the slaveholdings of a settler household has a positive effect on its likelihood of persisting in the Stellenbosch district panel. Slaveholdings is by definition in this dissertation's historical context, a capital investment among crop and wine farmers (Guelke and Shell, 1983; Fourie, 2011; Martins, 2019). Therefore, slaveholdings is a robust indicator of overall household wealth. The implication of the result in Table 2-8 is, therefore, that more agriculturally wealthy households in Stellenbosch had a lower proclivity to migrate from the district.

The number of sheep owned, played a positive role in encouraging settlers to exit the Stellenbosch district. The positive coefficient for sheep owned, serves as an indication that districts other than Stellenbosch offered conditions that were more favourable for extensive sheep farming. Settlers practising livestock farming at the Cape were more likely to move around in search of greater grazing pastures for their growing herds of livestock. The less densely populated frontier region, mountainous terrain and closer proximity to pastoral native Khoi tribes, was an ideal location for livestock farmers. The dry weather in the Cape during the summer months and reliance on grazing pastures for sustaining herds of livestock meant farmers needed access to large, open spaces (Guelke, 1982).

Owning sheep in Graaff Reinet was a determinant for household persistence in the district. Owners of large herds of livestock persisted in the district with the largest areas of grazing pastures. The more sheep owned the better off a settler household was in Graaff Reinet.

Finally, production diversity has the expected negative coefficient. Households capable of weathering negative shocks on production output of any particular output were more likely to persist in Graaff Reinet. Those that were hedged against shocks for any particular industry –

such as market downswings, for instance, were less likely to be forced out of the district panel when their major source of wealth is undermined.

As robustness check, this chapter repeats estimations of the complementary log-log models for a limited sample of households for which death year information is available. See Table 2-9. Death year information was obtained from the SAF.[36] An 'exit' event is assigned to those household heads that did not pass away on the date of their apparent 'exit'. The results were comparable with the results from the large sample estimates. For Stellenbosch the coefficients between the full sample and limited sample were nearly identical in magnitude, despite the large difference in sample size and marginal differences in the descriptive statistics presented in Table 2-1 and Table 2-2. These findings suggest that household heads that passed away, which may have been included as an 'exit' event in the larger sample, did not significantly impact the main survival model's results. The differences in the survival model are slightly more prevalent in Graaff Reinet's limited sample. Only household size was significant in explaining migratory decisions as opposed to household size, production diversity, and sheep owned. It is important to bear this in mind while considering the survival analysis results for the Graaff Reinet sample. However, these differences do not detract from the major conclusions in this research. With the closure of the agricultural frontier, poorer households located in frontier districts would have employed household members because of the diminishing land sizes and increasing populations (Cilliers and Green, 2018). It is, therefore, understandable that larger households would be less likely to migrate. Household size is likely the major determining factor of household 'exiting' Graaff Reinet. Existing empirical research vis-à-vis the economy of the frontier in the early nineteenth century (Cilliers and Green, 2018), as well as historiography concerning the frontier's closure (Giliomee, 1982) are consistent with the results returned here.

Table 2-9 Limited sample complementary log-log survival model for Stellenbosch and Graaff Reinet

Variables	Graaff Reinet	Stellenbosch
Household Settlers	-0.14*	-0.36***
	(0.09)	(0.07)
Indentured Khoi Labour	0.06	0.07
	(0.05)	(0.08)
Slaves Owned	-0.06	-0.14**
	(0.08)	(0.06)
HHI (Production Diversity)	0.25	-0.16
	(0.21)	(0.25)
Vines	-0.02	-0.04***
	(0.03)	(0.01)
Cattle Owned	-0.08	0.01
	(0.05)	(0.04)
Sheep Owned	-0.03	0.10***

[36] A comprehensive description for this dataset can be found in Cilliers (2016).

	(0.03)	-0.03
Constant	-0.90	-1.11***
	(0.17)	(0.15)
Number of Data Points	6,621	6,412
Number of Unique Households	1,022	899
Note:		Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

A final step in the survival analysis results section involves estimating the predicted hazard rates of exiting a district. Following the calculation of the hazard rates, they are included alongside the wealth index in a new parameterisation of the mobility models. This approach allows for determining if a relationship between the wealth mobility observed and the likelihood to survive in a district exists.

The model includes the starting log of the wealth index, y, the marginal hazard rate, the wealth and interaction terms between the starting wealth and the associated marginal hazard rate. Tables 2-10 and 2-11 exhibit the results for Stellenbosch and Graaff Reinet, respectively. For Stellenbosch, during the first half of the sample period, convergence is substantial, but it dissipates slightly across time. Convergence remains statistically significant.

The interaction term is interpreted alongside the starting wealth index coefficient. For settler households with nearly zero chance of exiting the district panel, the level of mobility is represented by the coefficient on the $\ln(Start\ Index)$ variable. In cases where the interaction term, $\ln(Index * Risk)$, is significantly different from zero, it is necessary to calculate the true level of mobility by adding the coefficient of the interaction term to the coefficient of the $\ln(Start\ Index)$. Depending on the nature of the relationship between the likelihood of dropping out of the district panel and the level mobility, the interaction term has either a positive or a negative coefficient.

Table 2-10 Conditional mobility model for Stellenbosch controlling for hazard rates, 1810 to 1829

	Δy1810	**Δy1811**	**Δy1813**	**Δy1814**	**Δy1816**	**Δy1817**	**Δy1818**	**Δy1819**	
	-0.51***	-0.50***	-0.73***	-0.68***	-0.66***	-0.82***	-0.76***	-0.75***	
ln(Starting Index)	(0.10)	(0.10)	(0.08)	(0.09)	(0.06)	(0.06)	(0.06)	(0.08)	
	-0.15***	-0.07***	-0.28***	-0.13***	-0.28***	-0.31***	-0.21***	-0.28***	
Marginal Risk	(0.03)	(0.01)	(0.03)	(0.02)	(0.02)	(0.05)	(0.01)	(0.02)	
	0.02*	0.01*	0.04*	0.01	0.03***	0.05***	0.03***	0.03***	
ln(Starting Index*Risk)	(0.01)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	
	2.18***	2.33***	3.50***	3.26***	3.30***	3.87***	3.67***	3.91***	
Intercept	(0.36)	(0.37)	(0.29)	(0.31)	(0.22)	(0.23)	(0.22)	(0.26)	
	Δy1821	**Δy1822**	**Δy1823**	**Δy1824**	**Δy1825**	**Δy1826**	**Δy1827**	**Δy1828**	**Δy1829**
	-0.51***	-0.55***	-0.43***	-0.49***	-0.51***	-0.44***	-0.54***	-0.60***	-0.49***
ln(Starting Index)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
	-0.22***	-0.19***	-0.16***	-0.15***	-0.18***	-0.13***	-0.13***	-0.11***	-0.10***
Marginal Risk	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
	0.01	0.02**	0.01	0.01*	0.01*	0.00	0.01***	0.01***	0.00
ln(Starting Index*Risk)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	2.79***	2.87***	2.33***	2.62***	2.90***	2.65***	2.76***	3.16***	2.82***
Intercept	(0.22)	(0.23)	(0.23)	(0.22)	(0.20)	(0.20)	(0.22)	(0.22)	(0.22)
Note:								*** p < 0.001, **p < 0.01, * p < 0.05 Standard errors in parenthesis	

The interpretation for the coefficients in the models of Tables 2-10 and 2-11 is simple. Firstly, in the case of a significant and positive interaction term and negative mobility coefficient, settler households in the sample that were more likely to exit the district panel, were those that exhibited less wealth convergence. Secondly, where a significant and negative interaction term and positive mobility coefficient were present, households that were less likely to migrate would only have done so conditional on the presence of lower divergence. Thirdly, interpretation becomes more tedious when the coefficients on the mobility and the interaction terms have the same direction. With such results, the relationships would be theoretically implausible with expectations. In the event of a negative interaction term and mobility coefficient, it would imply that those settlers that showed the greatest convergence would also have been the most likely to exit the district. A continuous finding of this kind across time for any of the two districts would have been a potential indicator for a speculator society. However, apart from 1817 in Graaff Reinet – which seems like an anomaly compared to the results of other years – no such cases exist in the results.

Table 2-11 Conditional mobility model for Graaff Reinet controlling for hazard rates, 1810 to 1828

	Δy1810	**Δy1811**	**Δy1812**	**Δy1814**	**Δy1815**	**Δy1816**	**Δy1817**	**Δy1818**	**Δy1819**
Intercept	1.94***	3.33***	3.32***	3.63***	3.31***	3.13***	1.62***	4.09***	3.56***
	(0.21)	(0.23)	(0.24)	(0.30)	(0.22)	(0.20)	(0.08)	(0.32)	(0.16)
Starting Index	-0.34***	-0.52***	-0.57***	-0.63***	-0.59***	-0.61***	-0.18***	-0.69***	-0.62***
	(0.05)	(0.06)	(0.06)	(0.08)	(0.06)	(0.06)	(0.03)	(0.08)	(0.05)
Marginal Risk	-0.19***	-0.28***	-0.20***	-0.26***	-0.37***	-0.27***	-0.03	-0.08***	-0.30***
	(0.05)	(0.04)	(0.03)	(0.04)	(0.04)	(0.03)	(0.02)	(0.01)	(0.02)
ln(Starting Index*Risk)	0.01	-0.01	0.01	0.00	-0.00	0.01	-0.21***	0.00	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)
	Δy1820	**Δy1821**	**Δy1822**	**Δy1823**	**Δy1824**	**Δy1825**	**Δy1826**	**Δy1828**	
Intercept	4.04***	3.81***	3.10***	4.05***	3.89***	4.05***	4.57***	3.02***	
	(0.19)	(0.23)	(0.18)	(0.21)	(0.22)	(0.26)	(0.26)	(0.26)	
Starting Index	-0.70***	-0.64***	-0.49***	-0.69***	-0.65***	-0.68***	-0.79***	-0.83***	
	(0.06)	(0.07)	(0.05)	(0.06)	(0.06)	(0.07)	(0.07)	(0.07)	
Marginal Risk	-0.33***	-0.29***	-0.19***	-0.28***	-0.14***	-0.18***	-0.10***	-2.41***	
	(0.03)	(0.03)	(0.02)	(0.02)	(0.01)	(0.02)	(0.01)	(0.01)	
ln(Starting Index*Risk)	0.01	0.02**	0.01	0.01*	0.01*	0.00	0.01***	0.01***	
	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	

Note: *** p < 0.001, **p < 0.01, * p < 0.05
Standard errors in parenthesis

For the Stellenbosch district, the size of the coefficient on the interaction term is greater in earlier years. Households exiting the district due to an absence of convergence were more prevalent. The effect is still present later on, albeit of a smaller magnitude. For all the years in the sample period, settler households that exhibited greater proclivity to migrate were those that experienced less convergence. For Graaff Reinet, the convergence effect on migration, however, is more prevalent in later years. During earlier years the interaction term is mostly statistically insignificant, suggesting that convergence earlier on in the sample did not play

such a significant role in a settler household's decision to 'exit' Graaff Reinet. With the closure of the frontier, Graaff Reinet's population increased. There were consequently fewer opportunities to advance rapidly in terms of agricultural wealth. Cilliers and Green (2018) find that in the years after the closure of the frontier, poor families resorted to household members as major labour input as available land size diminished. Wealthy households, in contrast, substituted labour for capital as land availability declined. The results provide evidence for poorer households in Graaff Reinet leaving the district if they were unable to converge on their wealthier counterparts following the closure of the frontier.

Whether or not convergence was present in the Graaff Reinet district, was, therefore, less of a major determinant in the earlier years in the Graaff Reinet district panel. Settler households did not really consider the rate of their wealth accumulation relative to their neighbour in making migration decisions from Graaff Reinet, prior to frontier closure. In contrast to Neumark (1957), Graaff Reinet did not offer abnormal returns, but absorbed excess low-skilled, low-capital settler households. Negative selection was present as Graaff Reinet was a haven for households who were unable to successfully subsist or prosper in other districts. Households that were not satisfied with the inertia present in wealth accumulation in Graaff Reinet would have been more likely to exit after frontier closure.

Figure 2-6 illustrates the relationship between migration and mobility. Here the points marked '*X*' in the plot represent years in which the interaction term was statistically significant. The filled dots denote years in which the interaction term was not statistically significant, at least at the 5% level of significance. Noticeable is that for Stellenbosch the effect is more consistent – particularly in earlier years. In the absence of satisfactory levels of convergence, settler households that were the most likely to exit the Stellenbosch district were the least likely to exhibit convergence. For Graaff Reinet the effect is not as prominent earlier on. Convergence was not a determining factor in a household's decision to depart from the district panel. Only during later years did the effect become more prevalent. This coincided with the closure of the frontier which marked land sizes diminishing as the population grew. In the later years of the observation period – from 1824 and onwards in Graaff Reinet – when economic opportunities started diminishing because fertile and secure pastoral land became less prevalent, did the settlers dissatisfied with the levels of convergence opt to migrate.

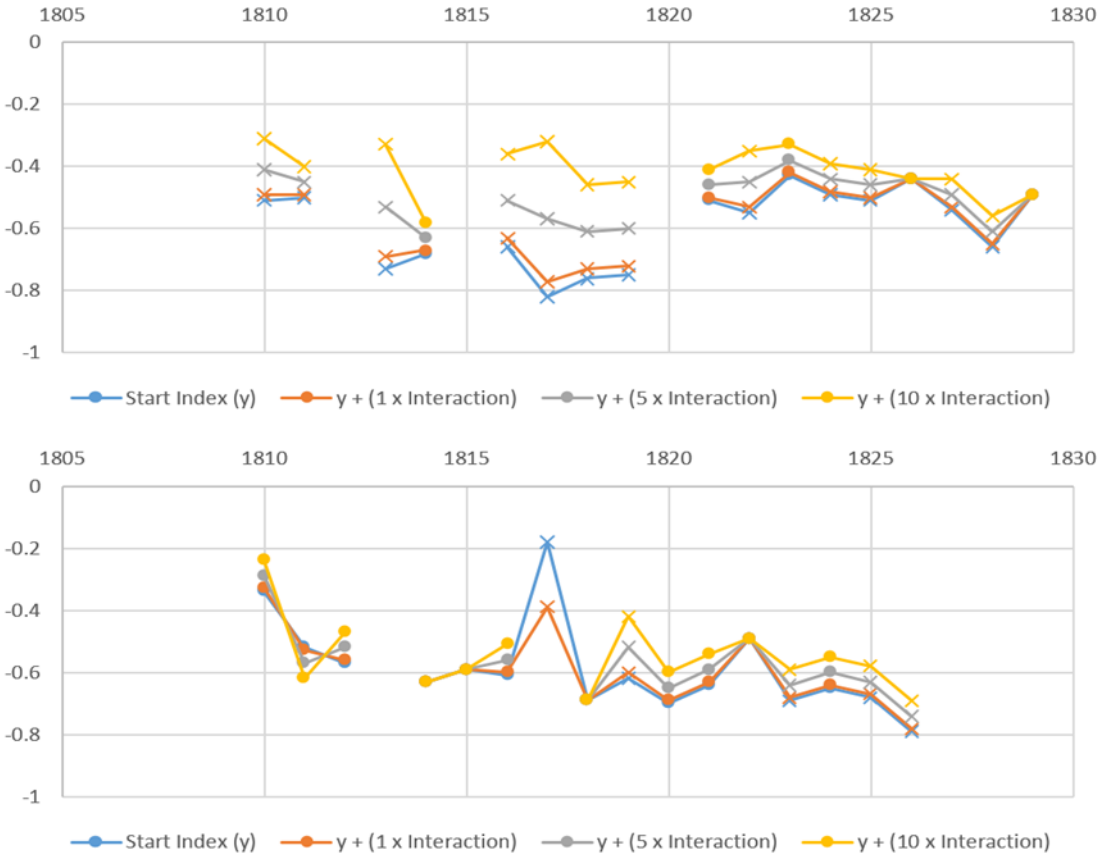

Figure 2-6 Graphical representation of the interactive effect between the likelihood of settler household migrating and the level of mobility experienced for Stellenbosch (top) and Graaff Reinet (bottom)

2.6 Summary and conclusion

In research concerning modern societies, migration is often associated with positive selection. This means that individuals with higher skills migrate to locations where they receive higher returns on those skills (Borja, Bronars and Trejo, 1992). Another possibility is negative selection. This occurs when a society is early in its development, has open borders, and population densities are low. These elements allow for an in-migration of unskilled or semi-skilled workers.

This chapter examined wealth dynamics and migration in the pre-industrial, historically underdeveloped Cape Colony during the early nineteenth century. The chapter focused on how wealth accumulation and inequality contributed to out-migration patterns of settler households located in two major districts with divergent geographies, ages and agricultural activities. A major objective was to establish if persistent inequality and low wealth mobility gave way to settler out-migration of low-capital, low-skilled settlers toward the younger district of Graaff Reinet with a low population density and lower entry requirements into livestock farming

activities. In other words, this chapter examined negative selection in the Cape Colony and how it was potentially driven by wealth distribution and persistent inequality.

Existing research for the economic circumstances in the Cape Colony find that income and material wealth were unequally distributed. There were, nevertheless, some opportunities to acquire wealth and for poorer households to advance on their wealthier counterparts in terms of SES (Du Plessis and Du Plessis, 2012; Fourie and Uys, 2012; Fourie, 2013). Recent studies, however, do not take an explicit look at wealth accumulation and the ability of poor households to converge on their richer counterparts. In addition to examining the relationship between agricultural wealth convergence and out-migration, this chapter fills the void of studying wealth dynamics in the Cape and a settler households' likelihood of migrating from a particular district subject to wealth dynamics and inequality.

Migration determinants in the Cape have yet to be a major focus of empirical analysis. This chapter attributes this deficiency to the lack of quality historical, micro-level data that enables migration and wealth dynamics analysis and the relationship between the two. The newly available digitised official tax censuses of the Cape Colony (*opgaafrollen*) containing asset and agricultural output data formed the focal point of analysis.

As a theoretical basis, this chapter contrasted the arguments of two major qualitative works regarding the economic drivers of migration by Guelke (1976) and Neumark (1957). The former's thesis was that struggling households in more mature districts like Stellenbosch were forced to relocate, due to high capital requirements to start and operate an arable farming venture. Price controls during the VOC's administration favoured large estates that practised extensive, arable farming. These farmers could force lower unit input costs through economies of scale. Households who had no other options could have opted to migrate to the frontier. At the agricultural frontier, capital requirements to set up livestock farming were much lower in comparison (Guelke, 1976). Neumark (1957) on the other hand suggested that the frontier region was filled with opportunities for considerable profits, given the low capital requirements for livestock farming. The promise of economic opportunity was the major driver for migration from established, arable farming regions (Neumark, 1957).

This chapter's major conclusion from the mobility estimates is that the frontier district of Graaff Reinet offered only marginally greater agricultural wealth-accumulation opportunities. This feeds into Guelke's (1976) theory that Graaff Reinet was a safety-valve society where

settlers with no other options migrated to subsist. They did not necessarily do so because the frontier offered considerably greater economic opportunities for abnormal returns.

The gini plot of agricultural asset ownership suggests that there was a steady increase in the level of inequality in Graaff Reinet that coincided with the closure of the frontier. Neumark (1957) does not regard the frontier to consist merely of subsistence farmers. Instead, the relatively more egalitarian district of Graaff Reinet offered considerably greater economic opportunity in the earlier years. The major economic function at the frontier, livestock farming, was more 'lucrative' since it required significantly lower start-up capital to reach the same level of success as in Stellenbosch (Neumark, 1957). However, the cost of social volatility in Graaff Reinet, in the form of skirmishes, wars and stock raids, was a sufficient deterrent for settlers to move there. They would only do so in the event of failing to break into the productive economy of the more mature districts, or when becoming disillusioned with the governing authority.

Results from the survival analysis show that the settlers who were the most likely to migrate from Stellenbosch, were those that showed the lowest levels of convergence. The economic conditions in Stellenbosch did not permit certain households to compete satisfactorily with their wealthier counterparts who had been in the district for longer and were hence less likely to exit. The theory suggests that it was struggling arable farmers who were the first to migrate. In Graaff Reinet, convergence (or a lack thereof) did not play a significant role in determining a settler household's exit from the district panel – at least earlier on. The inertia in the low wealth inequality population in Graaff Reinet was insufficient motivation for settlers to exit Graaff Reinet. This changed slowly with the closure of the frontier, however. The agricultural frontier closed completely in 1812 according to Giliomee (1982) and economic opportunities for settler households in the region diminished. During later years, households that were the most likely to exit Graaff Reinet, were those that exhibited the lowest levels of wealth convergence.

In terms of the broader picture of inequality, this chapter offers a contribution to understanding institutional motivations behind migration in an agriculture focused society. Where land is the most important production input, those individuals arriving late in the economy and who were not fortunate enough to settle on the most productive land first and entrench themselves in the local economy would find it challenging to be successful. Instead, the lack of sufficient opportunities to yield excess returns in the originating economy would in part motivate them to migrate to a location where land was in far greater supply and barriers into the productive

economy was less inhibiting. Naturally, this would imply that an originating society with significant entry barriers would see a prolonged and sustained level of inequality. The destination society, which is characterised by lesser entry barriers, in contrast, would be more egalitarian in its dispersion of economic opportunities to yield excess returns. These characteristics would make it more lucrative to those who were kept out of the originating region's economy through institutional inequality.

The results presented in this chapter could potentially have implications for first-mover advantages as well. This need not necessarily refer to geographic movement – but movement into alternative industries, which happens to be in other locations in the study at hand. Both Gregson (1996) and Stewart (2005) mention first-mover advantages in their analyses of migration to the US agricultural frontier. Migrants who moved first were not only able to acquire the best tracts of land first to pursue agricultural ventures, but they were allowed more time in which to acquire knowledge of the conditions relating to the geography, climate, soil and market conditions in their new location. Second-movers would consequently need skills and knowledge to benefit from any untapped opportunities in the new location not already exploited by the first-movers. Likewise, this chapter showed that settlers who were not content with the deficient opportunities at the origin found the untapped opportunities potentially present at the frontier more appealing. The changed at a later in Graaff Reinet after the frontier closed and deficient skills and expertise motivated settlers to migrate from the district as well.

Therefore, this chapter concludes that Neumark's (1957) thesis of abnormal economic opportunity at the frontier is erroneous. Results provide evidence corroborating Guelke's (1976) thesis. Struggling arable farmers and viticulturists were forced out of Stellenbosch. The extensive farming practised at the Cape, along with the slave-driven economy, favoured large estates who benefited from economies of scale. Graaff Reinet on the other hand, did not exhibit abnormal opportunities for settlers residing there. Mobility in Graaff Reinet and Stellenbosch were comparable. Graaff Reinet was, therefore, a safety-valve society. The district absorbed excess settlers from established districts. These settlers would have included those who had no other options but to seek refuge elsewhere after failed arable farming attempts. The difficulty of starting a viticulture operation, low livestock farming start-up costs and the ease of acquiring a grazing permit and a loan, motivated the migration toward the frontier district of Graaff Reinet. Not abnormal wealth accumulation opportunities. Negative selection was, therefore, at play in the migration patterns of settler households residing in the Cape Colony.

2.7 Appendix A

Since there were no continuous price dataset available for the various asset classes included in the agricultural wealth index, and valuing vines would prove a difficult task that is beyond the scope of this research, PCA was used to construct a composite wealth index. It would have been possible to simply use the nominal value of livestock and slaveholdings to calculate the asset holdings of each household. The relative importance of certain asset classes, however, would have been different if, for instance, one was to compare Stellenbosch district with the Graaff Reinet district. In Stellenbosch livestock farming would not have been such an important function fulfilled by settlers. Viticulture, and to an extent crop farming, were more prevalent in Stellenbosch. It becomes necessary to construct a wealth index that accounts for these structural differences across districts, if the objective is to draw inter-district comparisons in wealth mobility. Principal Component Analysis (PCA) is consequently employed to construct a composite metric that encompasses the maximum variation in a household's wealth when total asset holdings are considered.[37] In the PCA Chapter 2 includes all livestock, slaveholdings, vines, wagons and carts. After the values of all the asset classes are standardised, PCA is employed to identify the variables responsible for most of the variation, using the Keiser-Guttman criterion.[38] The index is then calculated by Krishnan's (2010) approach in his study in which a socio-economic index for Alberta province, Canada is calculated.[39] The component scores for each household in every year are multiplied with the proportion of variation explained by the particular component. For each year and for each individual household the index is calculated as indicated in Equation 2:

$$Index = \sum_{i=i}^{n}\left(\frac{w_i}{W} \times s_i\right) \tag{4}$$

In Equation (4), s_i is the associated component score, w_i is the weight attached to the particular component explaining the total variation in the original set of asset variables. W is the total variation in the original variables that is explained by the selected number of principal components. The PCA process generates component scores that are both negative and positive. However, a negative wealth metric is nonsensical given that the resulting metric from Equation (4) was directly used as the measure of wealth in the various mobility models in levels. The

[37] In R the '*principal'* function from the '*psych'* package is used to conduct the PCA analysis.
[38] The criterion is a way to determine which principal components are significant - those principal components that have Eigenvalues greater than the mean. See Yeomans and Golder (1982).
[39] Similar approaches are followed in the earlier studies of Filmer and Pritchett (2001), McKenzie (2005) and Vyas and Kumaranayake (2006).

empirical approach concerns calculating the change in wealth between a base year and subsequent year. Working with negative values would not allow this calculation strategy to deliver workable wealth index metrics. For instance, if a household A had a wealth metric of six in the current year and metric of negative two in the base year, the change in the wealth of household A would be calculated as (positive) eight. This chapter, therefore, proceeds to standardisethe obtained values to obtain a metric that ranges from 0 to 100 to obtain an index value.[40]

Table 2-11 presents the proportional variance explained by each of the components for each district. A small percentage of the total variation in a household's total asset holdings is explained by the first component. This small variance necessitated the construction of a weighted index using five components to capture the maximum level of variance explained by the selected number of components. The proportional variances explained are quite similar between the two districts for all components.

Table 2-12 Results from Principal Component Analysis

Stellenbosch					
Components	1	2	5	3	4
SS loadings	3.99	1.24	1.13	1.05	1.05
Proportion Variance	0.33	0.10	0.09	0.09	0.09
Cumulative Variance	0.33	0.44	0.53	0.62	0.70
Proportion Explained	0.47	0.15	0.13	0.12	0.12
Cumulative Proportion	0.47	0.62	0.75	0.89	1.00
Graaff Reinet					
Components	1	2	3	5	4
SS loadings	2.72	1.61	1.18	1.09	1.01
Proportion Variance	0.23	0.13	0.10	0.09	0.08
Cumulative Variance	0.27	0.36	0.46	0.55	0.63
Proportion Explained	0.36	0.21	0.15	0.14	0.13
Cumulative Proportion	0.36	0.57	0.72	0.87	1.00

[40] Standardisation is done using the formula: $\frac{(x-x_{i,min})}{(x_{i,max}-x_{i,min})}$

2.8 Appendix B

Table 2-13 Descriptive statistics for migrant limited sample for either district, 1805-1829

Migrant Limited Sample Stellenbosch								
Statistic	**Settlers**	**Slaves**	**Khoi**	**Cattle**	**Sheep**	**Vines**	**First Year of Observation**	**Final Year of Observation**
Mean	5	10	2	28	60	23893	1811	1820
Median	5	6	0	16	0	0	1817	1817
Minimum	1	0	0	0	0	0	1805	1806
Maximum	15	104	34	414	1810	310000	1828	1829
Range	14	104	34	414	1810	310000	23	23
n	1894	1894	1894	1894	1893	1894	252	252
SD	3	13	3	41	119	41098	7	8
Migrant Limited Sample Graaff Reinet								
Statistic	**Settlers**	**Slaves**	**Khoi**	**Cattle**	**Sheep**	**Vines**	**First Year of Observation**	**Final Year of Observation**
Mean	5	1	5	63	806	645	1813	1819
Median	5	0	2	40	528	0	1812	1818
Minimum	0	0	0	0	0	0	1805	1806
Maximum	14	24	50	634	7709	53000	1825	1826
Range	14	24	50	634	7709	53000	1813	1826
n	2488	2488	2488	2488	2485	2482	426	426
SD	3	3	7	73	896	3785	6	6

2.9 Appendix C

The results of the linkage procedure that was proposed by Rijpma, Cilliers and Fourie (2019) that applied it to the Cape Colony district of Graaff Reinet for the period 1790 until 1828. In this chapter applies it to the Stellenbosch dataset from 1805 until 1829. The results of the linkage procedure is presented here. Firstly, Table 2-14 describes the variables that were used in the linkage algorithm, which is consistent with other research examining record linkage such as Feigenbaum (2016)

Table 2-14 Decsription of variables considered in record linkage algorithms

Variable	Explanation
namefreq_from/to	Frequency of name and similar variants in full opgaafrolle dataset
mlastdist	Jaro-Winkler string distance between husbands' last names.
mfirstdist	Jaro-Winkler string distance between husbands' first names.
minidist	Jaro-Winkler string distance between husbands' initials.
wlastdist	Jaro-Winkler string distance between wives' last names.
wfirstdist	Jaro-Winkler string distance between husbands' first names.
winidist	Jaro-Winkler string distance between husbands' initials.
mlastsdx	Soundex string distance between husbands' last names.
mfirstsdx	Soundex string distance between husbands' first names.
wlastsdx	Soundex string distance between wives' last names.
wfirstsdx	Soundex string distance between wives' first names.
nrdist	Difference between position in year's opgaafrol.
bothyoung	Both individuals are identified as young.
bothold	Both individuals are identified as old.
dchildren	Difference in number of children present in households
spousenamedist_from/to	Jaro-Winkler string distance between husband and spouse surname
wife_present_from/to	Wife present in the "from" or "to" record
wifeinboth	Wife present in both records.
bothwineprod	Both records are indicated as wine producers
mtchs	Number of candidates for this record.

Source: Rijpma, Cilliers and Fourie (2019)

Similar to Rijpma, Cilliers and Fourie (2019), two alternative models formed the central focus in linking the Stellenbosch dataset. These two models were the random forest and logistic regression classifiers.

Figure 2-7 presents the sizes of the coefficients for the logistic regression and the relative significance of variables used in the random forest classifier. From the figure, it is clear there are certain common variables that are important in determining links, such as string distances between male first names and initials.

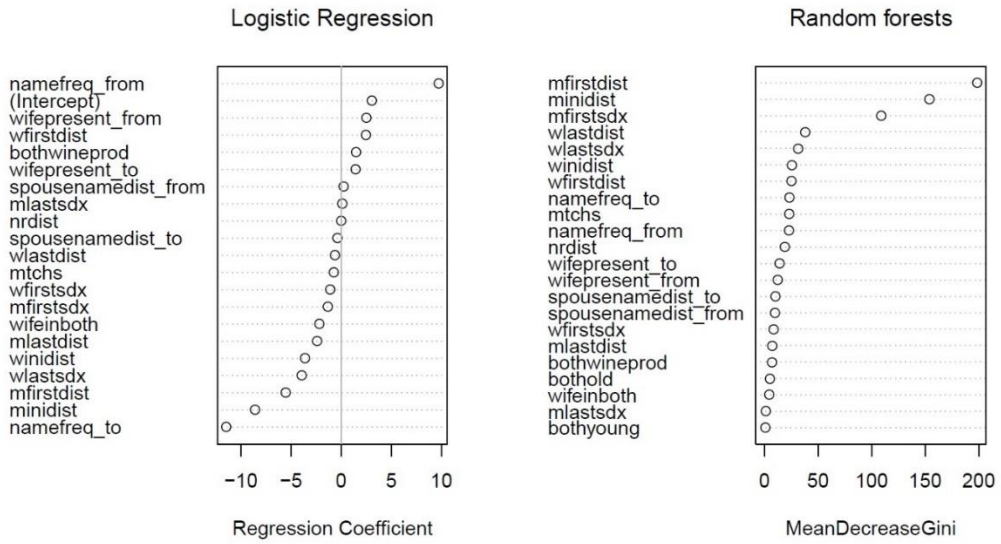

Figure 2-7Logistic regression coefficients (left) and parameter significance for random forest model (right)

Since the predictive performance of the models are what is most important, it is necessary to determine a threshold probability of a link being true. To accomplish this, the error rate needs to be minimised. This is established, in accordance with James *et al*. (2013), as the combined total number of false positive links and false negative links as a share of the total observations.

Figure 2-8 illustrates that the error rate was minimised below the threshold level of 0.5 and 0.56 for the logistic regression model and random forest model respectively. Of greater concern, however, is circumventing the creation of false links as opposed to missing true links.

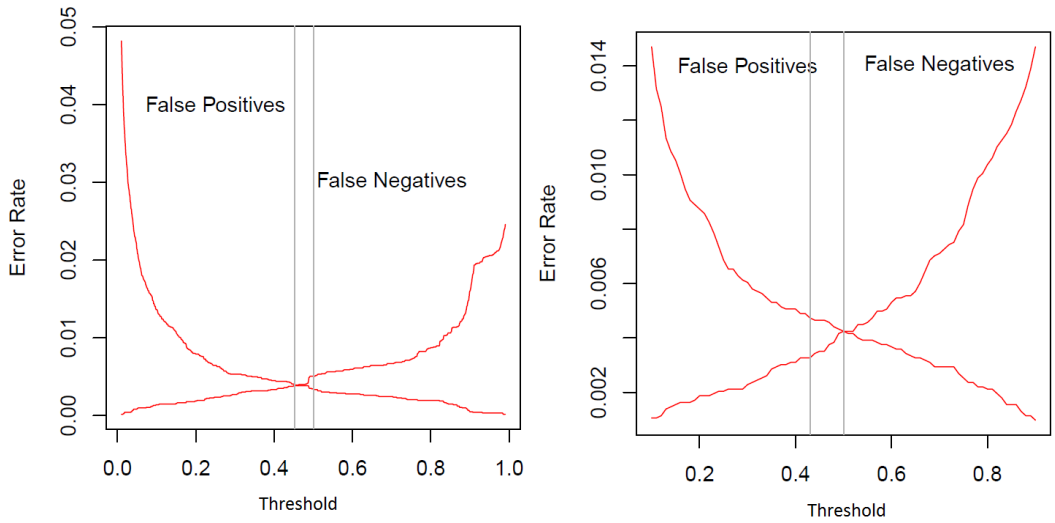

Figure 2-8 Total false links as a share of total observations as a function of threshold for logistic regression (left) and random forest (right)

Confusion matrices, Tables 2-15 and 2-16, are further illustration of the predictive performance of the two models. The tables present the true positive links, true negative links, false positives and false negatives for the training dataset and the test dataset. The high true negative links is expected, given that there are many candidates that are not actual links compared to the links that are. It is important, for this reason, to focus instead on recall and the precision of the respective models. The recall is calculated as the true positives as a share of total true positives and false negatives. The precision is calculated as the share of true positives of the sum of true positives and false positives.

Table 2-15 Confusion matrix for logit models

		Actual			
		Train		Test	
		0	1	0	1
Predicted	FALSE	11789	62	11813	75
	TRUE	42	351	52	341

Table 2-16 Confusion matrix for random forests model

		Actual			
		Train		Test	
		0	1	0	1
Predicted	FALSE	11813	18	11813	52
	TRUE	13	400	52	364

The recall for the logit model is high. As calculated from Table 2-15, for the training dataset, recall is 85% and for the test data, it is 82%. The random forest model has a very high recall on the training dataset at 96%; compared to 88% on the test dataset. Both models tested for linkage efficiency therefore performs well.

Of the two models, the random forest is preferred, however. The random forest model has greater precision on the test data – at 88%. The precision of the logit model is slightly lower at 87%. Given the importance of avoiding the creation of false links as opposed to missing true links, it is therefore prudent to opt for the model in this dissertation that produces the most precise estimates. The random forest model is therefore favoured.

Figure 2-9 exhibits the share of households linked in any year to any other year after employing the random forests model in the record linkage procedure. The average share of households linked in any year to any other year is greater than 80% for the majority of years.

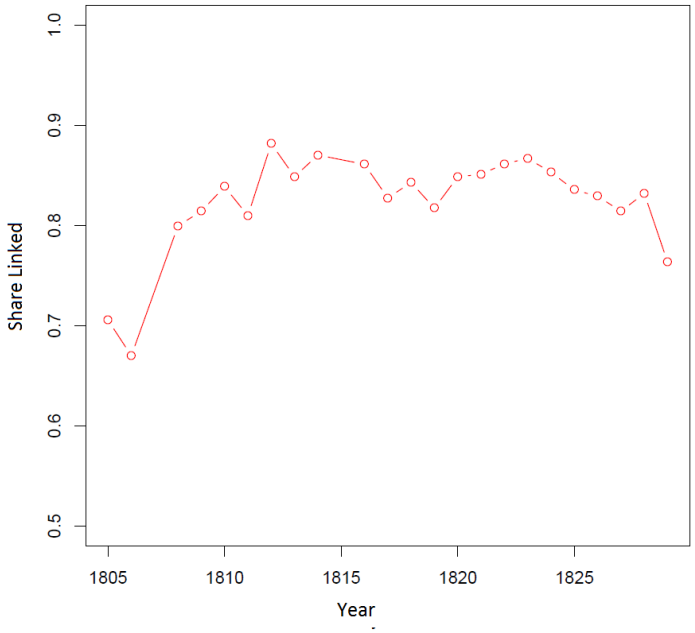

Figure 2-9 Share of households linked by year

The linkage procedure developed by Rijpma, Cilliers and Fourie (2019) and applied to the Graaff Reinet *opgaafrollen* therefore yields comparable results when applied to another dataset for a historical society, which could potentially have had different recording practices and resident characteristics. There is potential for biases in this linkage algorithm, however. For instance, the dataset generated from the procedure may be skewed toward married couples. It nevertheless provides high recall and precision links. The sensitivity and precision of the model are high and, at an excess of 80%, the overall linkage rate on the complete dataset is also high.

Chapter 3

3 Birth order and name inheritance: Distinguishing between material and psychological reasons for pre-industrial migration

3.1 Introduction

A controversial narrative within the diverse field of psychology research is differential parental treatment of offspring. It is theorised in the evolutionary psychology and child development subfields, among others, that siblings are born and raised in varying household conditions across time. The varying and often limited levels of affluence of breadwinners at the time of a child's birth and the need to distribute parental care and wealth among offspring may potentially give way to such differential treatment (Steelman and Powell, 1985; Taubman and Behrman, 1986; Salmon and Daly, 1998). In turn, the differential parental care implied by these varying conditions results in personality differences among children (Sulloway, 1996). A considerable amount of research examines the influence of sibship characteristics on personality traits of children, and the subsequent adult socioeconomic outcomes of these children (Taubman and Behrman, 1986; Majoribanks, 1989; Draper and Hames, 1999; Guastello and Guastello, 2002; Milne and Judge, 2009; Sulloway, 2010; Rohrer, Egloff and Schmukle, 2015; Rohrer, Egloff and Schmukle, 2017; Breining *et al.*, 2020). The results presented in this research is not yet conclusive, however. It is therefore appropriate to eliminate these mechanisms as a potential driver of socioeconomic outcomes in the current context. Inheritance laws, relatively large sibships and the geographic expansion of the Cape Colony suggested to have been present by Fourie (2013) qualifies this objective.

In the evolutionary psychology and child development research within the greater field of psychology, sibship sizes and relative positions of birth could be major determinants of adult economic outcomes. In addition, little is known about the impact that naming conventions and interactions within sibships have on the decisions of an individual to migrate. In the study at hand, which examines a pre-industrial society where agricultural success and migration were major economic outcomes, it is appropriate to, at the very least, rule out sibship effects that may influence these outcomes. This chapter explores the possibility of sibhship-induced personality differences being a major determinant of out-migration from the Stellenbosch

district. This chapter employs a unique dataset (in the form of tax and genealogical records) to answer two questions: 1) Are older children less inclined to migrate due to personality difference relative to their younger siblings? 2) Are children that share a common name with their parents more likely to persist as opposed to migrating?

Traditionally, the study of naming conventions contributes toward understanding the process of the naming of offspring after people of past societies (Smith, 1985). Smith (1985) maintains that this is a non-random process, but is instead deeply vested in cultural rules. Nevertheless, no research examines the results of naming practices on adult economic events such as migration in a pre-industrial context.

This chapter concedes that the literature concerning psychology and socioeconomic outcomes is dense and multifaceted. The analysis is by no means an exhaustive interdisciplinary undertaking. Instead, it is a means to eliminate another possible explanation for out-migration from Stellenbosch or identifying a vehicle through which wealth explains migration or persistence in a historically underdeveloped, pre-industrial society. In doing so, it only touches upon certain subfields within psychology including evolutionary psychology, child development, psychoanalytic perspectives and personolgy. The objective is two-fold. Firstly, the aim is to dismiss birth order giving way to personality differences among siblings, which result in varying tendencies to migrate. It is possible that preferential treatment of older children results in varying adult outcomes among siblings (Lindert, 1977; Smith, 1985; Taubman and Behrman, 1986; Majoribanks, 1989; Davis, 1997; Draper and Hames, 1999; Collings, 2009; Courtiol, Raymond and Faurie, 2009; Milne and Judge, 2009; Gibson and Gurmu, 2011). In addition, according to Adler (1928) and Sulloway (1996), siblings born in different positions may want to differentiate themselves from each other for a more equitable distribution of parental resources and care. Such differentiation may extend into adulthood and give way to differential socioeconomic outcomes, such as migratory decisions. Secondly, this chapter explores the possibility that cultural familial ties or loyalty, as proxied by name inheritance, is a significant determining factor of migration. There is a strand of literature investigating naming conventions' influence on personality and relationship with elders (Smith, 1985; Lieberson and Bell, 1992; Main, 1996). The study at hand examines the existence of such familial ties and whether it engenders varying adult socioeconomic outcomes between siblings that did not share a name with their father and those that did. The outcome of concern in this chapter is migration. To achieve the objectives, this chapter relies on descriptive statistics, plots, and most importantly, survival analysis to analyse determinants of migration. The

datasets used in this analysis are digitised versions of quality, individual-level, longitudinal historical datasets in the form of tax records (*opgaafrollen*), and the South African Families (SAF) register.

This chapter proceeds as follows: Section 2 provides a theoretical primer of particular theories relevant to this research and establishes a conceptual framework in which the research takes place. Section 3 reviews the literature underlying this research. Section 4 provides a historical overview of the Cape Colony's land ownership, inheritance and property rights, identification of the gaps in research, and contextualising these gaps as they relate to the unique historical setting and dataset of this chapter. Section 5 describes the methodology followed to produce the empirical results presented in Section 6.

3.2 Theoretical primer

Before proceeding with the literature review, it is necessary to provide a theoretical background of the theories that this chapter explore in its attempt to eliminate sibship-induced personality differences as explanation for settler households' migratory decisions in the pre-industrial, historically underdeveloped society of Stellenbosch. This section aims to establish a conceptual framework for the remainder of this chapter and informs the empirical analysis.

3.2.1 The Family-Niche model of Sulloway (1996)

Children develop the values and personality traits needed to maximise a limited supply of resources from their parents (Sulloway, 1996). This model is based on a Darwinian approach in explaining how offspring being raised in varying household conditions exhibits different personality development paths. Offspring born in different positions tend to exhibit varying physical and personality traits. In addition, Sulloway (1996) theorises that siblings in different birth-order positions eventually occupy different familial statuses. All of these differences give way to different siblings adopting varying strategies to make the most of limited parental resources and care. The competition among siblings for parental investment in their childhood development determines the experience of each sibling differently in their childhood household. Sulloway (1996) posits that firstborn and later born offspring are raised in different "family niches" for which alternative values and personality traits are required to thrive and maximise limited parental resources and care. Firstborn siblings would have received all of their parents' attention and care in what is arguably the vital period of their childhood development. These firstborn children are physically stronger and more intellectually developed than their siblings are. Because of this, they occupy a dominant status within their

parental household. Since these children would like to safeguard their dominant status, they will likely be more conservative and more willing to uphold the status quo. Later born offspring would be more liberal and seek to change the status quo in their parental household to acquire some of the status advantage held by their earlier born siblings.

3.2.2 The Five Factor Model of personality of McCrae and Costa (1999)

The Five Factor Model (FFM) of personality primarily adopts the basic principles of trait theory: it is possible to characterise individuals in terms of enduring patterns of thoughts, feelings and actions; it is possible to quantitatively assess traits; traits exhibit some cross-situational consistency (McCrae and Costa, 1999). Traits define the individual. They refer to recurring patterns of behaviour that characterise individuals and differentiate them from others. Traits allow for the discovery of empirical generalisations of the behaviour of others with similar traits. The assumptions underlying trait theory concerns what people are like and what a personality theory ought to do.

There are terms for thousands of such traits that determine an individual's behaviour which are largely redundant. For decades, factor analysts have attempted to summarise these thousands of terms by identifying their underlying dimensions. It was widely agreed upon that a group of five factors was adequate representation of all these trait terms (Goldberg, 1980; McCrae and Costa, 1985a; McCrae Costa, 1985b; Digman, 1990). Table 3-1 lists the five factors, the names frequently used to describe them and adjectives and questionnaire scale definers.

Table 3-1 Selected labels and definers of the five factors

Factor	Label	Adjective definers	NEO-PI-R facet scale definers
N	Neuroticism, Negative affectivity vs. Emotional stability	Calm – Worrying Even-tempered – Temperamental Self-satisfied – Self-pitying Comfortable – Self-conscious Unemotional – Emotional	Anxiety Angry hostility Depression Self-consciousness Impulsiveness Vulnerability
E	Extraversion, Surgency, Social Activity vs. Intraversion	Reserved – Affectionate Loner – Joiner Quiet – Talkative Passive – Active Sober – Fun loving Unfeeling – Passionate	Warmth Gregariousness Assertiveness Activity Excitement seeking Positive emotions

O	Openness to Experience, Intellect, Culture vs. Closedness	Down to earth – Imaginative Uncreative – Creative Conventional – Original Prefer routine – Prefer variety Uncurious – Curious Conservative – Liberal	Fantasy Aesthetics Feelings Actions Ideas Values
A	Agreeableness, Friendly Compliance, Socialisation vs. Antagonism	Ruthless – Soft hearted Suspicious – Trusting Stingy – Generous Antagonistic – Acquiescent Critical – Lenient Irritable – Good natured	Trust Straightforwardness Altruism Compliance Modesty Tender mindedness
C	Conscientiousness, Will to achieve, Constraint vs. Undirectedness	Negligent – Conscientious Lazy – Hardworking Disorganised – Well-organised Late – Punctual Aimless - Ambitious	Competence Order Dutifulness Achievement striving Self-discipline Deliberation

Source: Costa and McCrae (1992)

In a broader sense, the FFM refers to the entire body of research it inspired. However, neither the model nor the literature constitutes a personality theory. A theory organises findings to tell a coherent story. Personality may be viewed as a system. An adequate theory must define the system, specify its components, model the components' organisation and interaction and provide an account of the system's development (Mayer, 1998). Five-factor theory (FFT) is an effort to employ the current knowledge about personality to construct such a theory (McCrae and Costa, 1999).

According to FFT, mean-level changes in behaviour occur because of genetic predispositions to change in specific ways (Roberts, Wood and Smith, 2004). In other words, "personality traits… are endogenous dispositions that follow intrinsic paths of development essentially independent of environmental influences" (McCrae *et al.*, 2000). Personality develops from life experiences, life events and lessons learned from living life. Neither the aforementioned factors nor shared experiences influence an individual's "basic" traits. If change does occur, it is because of a species-wide genetic predisposition to develop in a particular way. Within this framework, humans are predisposed to become more socially dominant, agreeable, conscientious, emotionally stable and less open to experience with age.

3.2.3 Sibling Rivalry Theory of Adler (1927, 1928)

A part of the psychoanalytic movement of the early 1900s, Alfred Adler emphasised the significant role played by external social influences on individual behaviour and development. It was Adler's position that early childhood experiences had important implications for a child later in adulthood. The family system, which included sibling interactions, was central to personality development. The major components in Adler's (1927) theory was the inferiority complex and its implications for individuals' lifestyles and management of their self-esteem. Social comparisons and power dynamics within the family system were central determinants to an individual's sense of self. The role of the inferiority complex led to Adler (1927) advocating the importance of egalitarianism – including equal treatment of siblings – as a preventive measure in supporting self-esteem. It is also possible that individuals create maladaptive coping mechanisms when exposed to circumstances that are less favourable to themselves than others are that may entrench themselves in their lifestyles.

The role of sibling experiences in personality development served as foundation for Adler's (1927) interest in birth order's effect on personality. Adler (1927) also argued that birth-order effects were vital in siblings' competition around parental care and resources. The rivalry among siblings find origin in each offspring's need to do away with potential feelings of inferiority. To reduce this rivalry, siblings find it necessary to differentiate. They develop varying personal qualities and select different niches to fill within the family system (Adler, 1928). In this differentiation process, siblings either consciously or unconsciously attempt to define themselves differently from one another in order to produce their own identities within the family and acquire their fair share of parental resources and care. Through the mechanism of sibling rivalries, sibling differentiation is crucial in supporting more harmonious sibling relationships. Parental favouritism manifests itself where sibling relationships are particularly poor.

3.3 Literature review

The theoretical primer presented in the previous section should establish the conceptual framework in which the remainder of this chapter takes place. It should serve as reference point for the following section – including this section, which reviews the relevant literature concerning sibsip characteristics and their influence on adult socioeconomic outcomes.

The number of siblings and their birth order are potentially major contributors to shaping siblings' personalities and consequently adulthood decision-making. Secondly, it explores

naming conventions' role in determining adult economic outcomes and whether it could compound the birth order effect.

3.3.1 Sibling ship size and birth order

The literature on siblings' effect on childhood care, personality differences, and adult outcomes is plentiful for modern societies. Considerably less empirical research exists that examines historical, pre-industrial contexts. One hypothesis that this chapter explores is offspring's upbringing varying according to birth positions. These differences in upbringing could manifest themselves through personality, inheritance practices, or naming conventions. The aim is to determine whether the first two factors dominate *vis-à-vis* the third.

Each subsequent sibling born into a household alters the environment in which they are raised in terms of social interaction and parental care and resources (Horton, 1988; Davis, 1997).[41] Any evidence for inheritability of personality does not negate the role of parental care (Bouchard, Lykken, McGue, Segal and Tellegen, 1990; Bouchard and Loehlin, 2001). The family unit is the first unique social setting a child experiences, and is different for each subsequent sibling born. The addition of new siblings, the order in which siblings are born, and the space between each birth determine the social characteristics of the family unit.

One significant limitation in studying the past is the absence of recorded personality traits. Since attention is on the economic outcome of migration, it is possible that sibling differences in settlers' childhood homes could partially explain out-migration decisions. Several studies suggest that extraversion and openness – prevalent among later-born children (Miller and Maruyama, 1976) – have positive effects on the likelihood of migration (Silventoinen, Hammar, Hedlund, *et al.*, 2007; Jokela, 2009; Canache, Hayes, Mondak, *et al.*, 2013). Greater sociability contributed positively to migration over long distances (Jokela, Elovaino, Kivimaki, *et al.*, 2008).

Firstborns may be the recipients of considerable parental favouritism (Sulloway, 1996). Last-born offspring, in contrast, may benefit from having no younger siblings that dilute parental resources, as older siblings start leaving the parental household. An alternative way to explain the effect of parental resource dilution is the scattering of a fixed financial resource in the form of agricultural assets – particularly agricultural land. This explanation is mostly applicable in

[41] Parents do not necessarily discriminate among children regarding their allocation of care and resources. Instead, they are unable to allocate resources equitably over a long period of time, to offset the unavoidable advantages accruing to children born first (both financial advantages and parental care).

the current pre-industrial, mainly agrarian context. The more children were born, the more diluted available parental investment would be. Younger offspring would have received a smaller portion of parental financial resources than their older siblings, which may have negatively affected their relationship with their parents. Middle-born children are worse off, since sibling competition in the parental household would be at its highest. These offspring live for longer periods competing for parental resources. The eldest siblings would only have experienced increased competition gradually. They would have had no competition at the earliest stages of their lives. Younger siblings would have had less competition for parental resources later in their adolescent lives. At no stage would middle-born children, have enjoyed parental investment to the extent of firstborn or the youngest siblings.

The variable childhood household conditions inherent to different birth positions ultimately lead to differences in various adult outcomes. These outcomes include schooling achievements and earnings (Lindert, 1977; Taubman and Behrman, 1986), social attainment (Majoribanks, 1989; Davis, 1997), fertility and reproduction (Draper and Hames, 1999; Milne and Judge, 2009), land ownership and agricultural productivity (Gibson and Gurmu, 2011), investment decisions (Courtiol, Raymond and Faurie, 2009), for the unique case of the Canadian Arctic, hunting success (Collings, 2009) and .

Birth order has a significant effect on the social role that an offspring occupies. Later born offspring occupy a different social role than earlier born offspring (Draper and Hames, 1998). Later-born offspring have more competition from older siblings (Sulloway, 1995; Sulloway, 1996; Sulloway, 2010). Later born offspring also have more individuals within the family unit on which to model their behaviour. It is, therefore, plausible that this could permit younger offspring to be more adaptable to changing circumstances and competitive environments. They are consequently more likely to thrive in new environments and hence be more likely to migrate.

From a biological perspective, younger, healthier parents with greater vitality and being healthier, potentially confer first-born advantage (Draper and Hames, 1999). With each subsequent offspring, additional conceptions become less desirable and differences in pre-natal care could affect the development of later-born children. Evolutionists, in contrast, look at first-born advantage from another perspective and have other reasons why they have an advantage relative to their siblings. Firstborns and older siblings are more important to parents in terms of their reproductive value (Salmon and Daly, 1998). As offspring get older, their relative value

increases since they systematically require more parental investment to replace (Barash, 1975).[42] Parents' favouritism toward the eldest offspring may potentially not be very apparent, due to changing parental needs and offspring capabilities. In life or death situations, however, when only one child can be saved above others, the parents would opt to save the eldest, since the eldest has the greatest chance of reaching adulthood (Davis, 1997). No other research exists that makes this bold claim. It is plausible, however, that when resources are limited, parents would opt for the eldest to climb the social ladder if they had no other choice. This is consistent with the Confluence Model in the sociological literature that hypothesises firstborns as being particularly advantaged from having no other siblings – at least initially – who decrease the family unit's total intellectual value (Jæger, 2009).

Since parents favour firstborns ahead of their siblings, they are more likely to defend parents' customs and traditions (Sulloway, 1995; Sulloway, 1996). Offspring born first prefer the *status quo* since they benefit most from their sibship position; offspring born later are likely to be more rebellious. It is plausible that older offspring could aid their parents in raising their younger children, which would further increase firstborns' perceived value. Older offspring's involvement in raising their younger siblings, affords parents more time to conceive additional children or engage in economic activities (Hames, 1988).

Recent literature, however, suggests that there is an insignificant relationship between personality trait development and birth order – if any relationship at all. For example, Freese, Powell and Steelman (1999) dispute the arguments of Sulloway (1996). Using a modern dataset from the General Social Survey (GSS) other variables that Sulloway (1996) discounts in influencing personality trait development such as family size and social class, among others, are more significant than birth order in explaining differential personalities among siblings. It is more likely that birth order is significant in shaping personalities in modest terms in unique scenarios. Harris (2000) supports scenario-specific conditions as a more significant contributor in shaping siblings' divergent personalities. Individuals would rather opt to wait for confirmation that their behaviour in a particular Scenario 1 is also applicable in another Scenario 2 before transferring certain behavioural patterns among scenarios. Indeed, another

[42] An offspring's probability of survival changes from very low to very high as they age, inclining parents to defend them more rigorously from predators as they age (Montgomerie and Weatherhead, 1988). The value of the offspring for the parent increases with age. Offspring born first would have absorbed more parental time and investment than younger children (Voland, 1998), therefore, the loss incurred from losing older offspring is greater than when losing a newborn. This theory might be the most appropriate in technologically primitive societies with little to no quality or modern health care.

study in a modern context using ANOVA to examine Midwestern US college students returns no significant relationships between various personality traits and birth orders (Guastello and Guastello, 2002).

Rohrer, Egloff and Schmukle (2015) argue that research examining the role of birth order in determining an individual's personality has yet to return conclusive evidence. There is a contrast in the results returned for modern research and dated literature. Indeed, older studies support the idea of a significant relationship between personality and birth-order, while modern research generally refutes this hypothesis. There is, nevertheless, a possible significant effect between intellect and birth order. No such effects exist for birth-order and various personality traits for three large national panel datasets in a modern setting, however. Additionally, Rohrer, Egloff and Schmukle (2017) note the longevity of the research examining birth-order and personality. Al the specification-curve analysis employed confirm a significant effect between birth order and intellect, Rohrer, Egloff and Schmukle (2017) report no relationship between birth order and various personality traits including extraversion, agreeableness and conscientiousness, among others.

In contrast, Breining *et al*. (2020) finds that delinquency is significantly more prevalent among second-born sons of Denmark and Florida. Second born male siblings are more likely to be reprimanded in school and enter the criminal justice system compared to their first-born male siblings. The authors rule out biological differences at birth and quality of education received as potential mechanisms explaining these higher second-born son incarceration rates. Parental investment is greater for firstborn sons at the crucial age of two to four. Parental investment into firstborn offspring is lengthened upon the arrival of a second born child.

Rossi (1965) attributes divergent results from birth order studies, to a particular developmental sequence. Firstborns, for instance, Rossi argues (1965), have an immediate advantage over their siblings within their entire kin group. As a first-born boy, a child may be encouraged to develop a self-image as the elected one, to make substantial achievements for both his and his family's benefit. Being the first male grandson, nephew and offspring, a child may encompass additional motivation for notable accomplishments compared to his siblings. Birth order has long been considered a significant factor to be taken into consideration when examining

psychology of sibling interactions and kinship. Rossi (1965) also shows that it may be an important determinant of kinship characteristics.[43]

3.3.2 Naming conventions

There is a strong relationship between birth order and naming conventions. Earlier-born siblings are more likely to inherit a name from elder kin (Finch, 2008). Upon the birth of the first child, it symbolises changes in the roles of various kin (Rossi, 1965). For example, parents' parents assume the role of grandparents while parents' siblings acquire the roles of aunts and uncles. There is a significance between paternal grandparents and the first grandson being born, as it ensures familial continuity and extension of the patrilineal line. Rossi (1965) argues that considering birth order alongside naming conventions, adds another dimension to the literature relating sibships to psychological differences. It could consequently be possible that any naming convention effect compounds the birth order effect or capture a degree of it.

In Stellenbosch, there was a correlation between birth order and naming conventions, as well. It is, therefore, possible that any sibship effect on the likelihood to migrate could be exclusively due to shared names and the familial ties it engendered or loyalty effects it cultivated. Offspring that inherited a name from elder kin may be the subjects of favouritism as far as care and investment is concerned. They could consequently reciprocate some of this preferential treatment by opting to remain closer to family and not migrating. For the modern United States, Barry (1979) alludes to this closer bond between sons and fathers that share a name. This stronger relationship between sons and fathers sharing a common name leads to these sons assuming a more authoritative role among their siblings. Davies (2011) also identifies naming as vital in empirically examining familial connections.

The process of naming children is essentially a social practice (Lieberson and Bell, 1992). Naming patterns that emerge from this process result from a combination of the following factors: the meaning of a name, parental ideals for offspring, expected response of third parties to the name, how the media informs parents about names, the belief that status and names are intertwined and societal norms.[44] Some of these factors will be more or less applicable in the

[43] Birth order, while also taking naming conventions into consideration, is suggested to be – as was also the conclusion in the more recent literature discussed in the preceding subsection – a vital determinant of kinship structure. Birth order, Rossi (1965) argues, has implications for kinship interactions as well the development of an offspring's personality.

[44] Parental ideals for their offspring is also noted and expanded upon by Lieberson (1984). The imagery that potential names for the children hold for their parents, and its interaction with the expectations parents have for their child at birth, influences the choice of name. This imagery is argued to be consistently changing in a society, as well as the expectations that parents have for their children.

context of a pre-industrial, agrarian society. Indeed, naming remains integral to family construction and kin identity (Davies, 2011). Children may reflect on their family surnames and the associated identities it constructed. Additionally, surnames act as a symbol of family connections that serves as a signal to others of family connection among people. Even though children do no choose their own surnames or with whom they share surnames, they still consider them as identifiers to others in establishing who these children and their kin were. Children's assumptions about who shares their surname reinforced the continuity of patronymic naming conventions. In their shared family imaginary, children reconstruct norms surrounding the family.

In the contemporary United Kingdom, Finch (2008) argues that names have a dual function: it anoints the child with individuality and marks social connections. It is possible for both surnames and forenames to ground the individual within family relationships. In the study at hand, this could manifest itself as an unwillingness to abandon the familial homestead to migrate further away. The Anglo-Saxon tradition of offspring adopting the surnames of their fathers, except if they choose otherwise, follows a predictable pattern, which signifies kin relationships to others. On the other hand, where surnames may ground the individual in a family network, the choice of first name introduces the offspring to the dimension of individuality. The selection of offsprings' names is a means with which parents choose to confirm or reinforce those familial relationships that are the most important to them. Names from people in previous generations are used for offspring that are expected to be alive for an extended period. The major contributing factor behind parents naming a child after kin from previous generations is not much an issue of 'preserving' a particular name than it is to acknowledge a specific kin relationship important to them and giving that kin's name a life span extension through their offspring.

Naming conventions in Hingham, Massachusetts from 1641 until 1880 were based in part on the belief that naming a child was an integral part of the genealogical chain spanning over generations (Smith, 1985). Similarly, for a more modern context in naming boys, parents considered historical continuity and stability (Lieberson and Bell, 1992). Naming a child after a parent was a method of stressing the family line, while children not named after their parents were an indicator of individuality being emphasised (Smith, 1985). The significance of continuing familial lines varies among societies (Main, 1996). Naming a child after a family member tends to be an indicator of a desire for traditionalism and familial continuity. Moreover, the family member after which a child is named is reflective of the family

hierarchy.[45] This is likely to differ, however, depending on place and time. Evidence of firstborn offspring being the most likely to inherit kin-related names reinforces the importance of temporal continuities. Rossi (1965) suggests that this may be due to parents regarding firstborn offspring as the ones who create a new generation. It is, therefore, significant to name the first-arrivals of a new generation in a way that establishes a connection with previous generations. In a similar vein, Kramer (2011) argue that genealogy allows people to produce, express or deny kinship, affinity and connectedness among themselves, close family and wider kin – within and across generations. Individual identity is firmly anchored to kinship networks. Kinship in itself remains central to personal lives.

Wealth also exerts some influence on naming conventions (Smith, 1985). Historically, it was offspring of wealthy, land-owning Americans that inherited names (Taylor, 1974). Other social groups only adopted the practice later on. Familial continuity is, therefore, of greater importance for wealthier households than for poorer ones. Smith (1985) notes that the practice in Hingham before the nineteenth century to transfer names to children, illustrated that parents had a sense of 'family' and a desire for familial continuity.[46] A stronger familial bond or kinship among families, indicated by name inheritance, could potentially have served as a determinant for persistence or against migration.

If name inheritance is correlated with birth order, it could likely influence persistence in or migration from the district. A caveat by Lieberson (1984) is that given names do not exclusively determine adult economic outcomes. Indeed, much more factors than just given names determine future success. It is still plausible, however, that the child-parent relationship could be affected by the child's given name. In turn, the relationship exert some kind of influence on the child's likelihood to migrate.

A conflation of the interaction among kinship ties, through the name given to an older offspring and their eldest status in determining the adult outcomes of the child, is possible. The importance of earlier-born offspring to parents and the patrilineal line is complex and justifies further exploration in a historically underdeveloped, pre-industrial context.

[45] This conjecture is also made by Rossi (1965). Relatives are different in the social and emotional importance they hold for parents when deciding what to name to give their child.
[46] Lieberson (1984) notes that moving away from naming children for ancestors, serves as an indicator that there was a decline in the importance of extended family and generational continuity.

3.4 Historical background

This section provides an overview of the historical context in which the analysis takes place. The chapter analyses a large district of the Cape Colony during the late eighteenth century and the first few years of the nineteenth century. The Stellenbosch district, established in 1679 (located 40 kilometres from present-day Cape Town), situated in the modern-day Cape Winelands, was relatively mature with little available fertile land for the observation period of the study at hand. It was not characterised by much volatility as compared to the agricultural frontier, for instance, in terms of migration, wars, skirmishes and raids. Traditional belief posits inheritance as the major vehicle for sons to acquire agricultural wealth, remaining in the Stellenbosch district, and running a profitable farming operation.[47] One argument is that brothers born earlier would have been more likely to inherit a greater proportion of their father's estate. They would consequently be less inclined to migrate or less likely to be forced out of district to support themselves. The aforementioned was observed by Gross (1996) for German immigrants in rural nineteenth-century Stearns County, Minnesota in the US. Firstborns would inherit the paternal farm. Sizes of first-born farms were also larger. Primogeniture, which entails parents bequeathing the largest portion of their estate, was found to have deterred international or internal migration among Norwegian men during the Age of Migration (1850 until 1913) (Abramitzky, Boustan and Eriksson, 2013). Dutch practice usually involved multigeniture where the paternal estate is divided equally among offspring after the largest portion is left to the widow. In Dutch dominated eighteenth-century New York City, primogeniture was actually the preferred practice (Alston and Schapiro, 1984). This suggests greater agricultural wealth among older siblings.

Prior to 1813, the Cape followed a system in which three types of land tenures were present – free hold, loan-lease and quitrent. As much as five-sixths of all occupied land in the Cape Colony, however, was held under loan tenure prior to 1813. De Kock (1924:150) summarises the supposed major negative effects of this type of land tenure system. Legal insecurity resulted in the absence of an incentive to improve the land.[48] Land was easily acquired, inducing greater

[47] According to the De Kock (1924:16), there were approximately 5000 colonists present in 1750 in the colony and 15000 in 1795. After this, the population grew consistently from 26720 colonists in 1806 to 66000 in 1832 (De Kock, 1924:135). This was coupled with a systematic expansion towards the east which is partly explained by the lack of fertile land that could support successful farming ventures. The first major push toward eastward expansion came in 1700 when the Governor Willem Adriaan van der Stel established the settlement of Waveren (De Kock, 1924:18). This expansion would extend as far as the Great Fish River, a thousand kilometres east of the central economic hub of what is present-day Cape Town.

[48] Swanepoel and Fourie (2018) argues that the *de facto* property rights of different landownership tenures in the Cape Colony were no different when used in debt transactions, even if their *de jure* property was very different.

migration. Regardless of the relative fertility or lay of the land, authorities imposed an unfair flat rent charge on land. Without title deeds or surveys, confusion surrounded the boundaries of a particular plot of land. Neumark (1957) believed that ill-defined property rights contributed to the eastward expansion of the Colony and the migration of stock farmers into the interior. While the government, according to De Kock (1924:151), rarely repossessed land they issued on loan, it was uncommon for farmers to apply themselves fully to the advancement of the land that they held under loan.

Leaseholders could not bequeath land held in loan to children upon their death (De Kock, 1924:151). This had implications for agricultural activity – not only the type of activity practiced, but also the intensity of that activity. The absence of certainty surrounding land ownership (in terms of boundaries and future occupation), could have had consequences for profitability and effectively the likelihood of a farmer 'surviving' in their agricultural venture. Before 1813, leaseholders could only sell or bequeath the buildings on the leased land. The buyer or beneficiary of these buildings or *opstal* was obligated to honour the terms and conditions of the loan agreement. It was possible for a father to have bequeathed the *opstal* to offspring prior to 1813, thereby making the son the holder of the loan agreement.

De Kock (1924:152) notes that the supposed insecurity inherent to the loan tenure system was not the only factor that resulted in the expansion of the Colony into the interior regions. Instead, it was a confluence of effects. The ease of land accessibility in the interior also partly explained the expansion. Rather than permanently settling, conserving pastures and water supplies and developing a particular piece of land, settlers would apply for a permit to a new piece of land and migrate there if circumstances required it.[49] The ease of acquiring land inherent to the lease system suited pastoralists perfectly. The characteristics of their agricultural operations gave them no reason to pursue an arrangement that bestowed greater *de jure* property rights.

Those settlers who held land on loan did not opt to convert their agreements to perpetual quitrents in considerable numbers. De Kock (1924:154) provides two major reasons for this: 1) Firstly, the settlers had grown accustomed to the loan-lease system of landownership and their conservatism would have caused them to be averse to any novel regulatory change. 2) Secondly, the rent in the perpetual quitrent system was higher than under the loan-lease tenure

[49] Under such circumstances, the land previously or currently occupied, had become inadequate for the grazing needs of the settlers' livestock.

for those farmers that occupied a comparatively more fertile and geographically favourable tract of land.[50] Converting a loan agreement to perpetual quitrent transpired only gradually.[51]

Under the Roman-Dutch law of inheritance followed in the Cape Colony, widows received two-thirds of a deceased husband's estate. The remainder of the estate was sub-divided among offspring. When arable land grew in short supply, it was more likely that children had to wait for their inheritance if they intended to farm (De Kiewiet, 1941:191).[52] When land became scarcer, Roman-Dutch Law compelled fathers to subdivide their estate among their children. The inefficient subdivision of limited supplies of arable land and backward farming techniques among especially less competent and inexperienced farmers, eventually lead to entrenched poverty and possible insolvency (De Kiewiet, 1941:191).

3.5 Methodology

3.5.1 Data

To reach the objectives presented in the introduction of this chapter, the chapter employs digitised versions of the official tax censuses, or the so-called *opgaafrollen* of Stellenbosch. These were records kept by the governing authority at the Cape to calculate the amount of tax payable by settler inhabitants to the Dutch East India Company (VOC) and later the Batavian and British governments. Authorities calculated this tax on the agricultural output and amount of agricultural assets owned. The records were linked to follow households longitudinally, using a string distance matching algorithm, relying on names and surnames of household heads and spouses and various other identifiers. The procedure employed in this linkage is similar to that of Rijpma, Cilliers and Fourie (2019).

This chapter further rely on the SAF to obtain demographic indicators.[53] The SAF is linked to the *opgaafrollen*, relying on names and surnames of household heads and spouses. Dates of birth and death are logical exclusion restrictions.[54] The register includes data on sibling

[50] Geographically favourable could refer to the climate, location with regards to the central economic hub for which to sell produce, and the lay of the land, i.e. mountainous or relatively level.
[51] There was a limit on the size of the farm on which a perpetual quitrent agreement was issued: approximately 3000 morgen, which were at first measured as a half-hour's walk from a central point in all directions.
[52] During earlier years, sons (with sufficient capital) could apply for custodianship of a particular plot of land from the Dutch-East India Company (VOC). De Kiewiet (1941) is not explicit in what he defines as 'earlier' or 'later' years in this particular section of the text. 'Earlier years' means prior to British administration - before the turn of the 1800s – and later years would, therefore, refer to everything beyond that.
[53] This dataset has previously been examined extensively by Cilliers (2016) whose particular focus was granted to the fertile land at the Cape Colonial frontier as well as the gender composition of the colony.
[54] For a match, a settler could not have been older than 100 years, less than 15 years (the age of first appearance in the *opgaaf*), or already passed away – *opgaaf* year exceeds the year of death.

identification, years and place of birth and death, as well as marriage information. The way the identification codes in the SAF are constructed, makes it possible to determine the demographic variables of parents. Cilliers (2016) provides a full description of this dataset. Essentially, the constructed identification codes in Cilliers (2016) links genealogies. That is to say, the codes enable researchers to link sons to father, fathers to grandfathers, grandfathers to great-grandfathers and so forth. It allows for identifying siblings as well. After linking the SAF to the *opgaafrollen*, this chapter can consequently analyse the precedence of name inheritance in the Stellenbosch district as well as birth order effects on migration and wealth accumulation.

The preliminary analysis includes the entire sample period. This analysis estimates models only from 1775 to 1803. There is over 10000 data points in this unbalanced panel dataset with 3095 unique settler households. The reasons for focusing on the 1775 to 1803 period only is due to significant government and regulatory changes as well as recordkeeping methods. This period should be stable at least as far as recordkeeping practices and colonial borders were concerned. This should ensure that significant recordkeeping and colonial boundary changes do not muddle the survival analysis results. Since males were generally regarded as household heads, it simplifies the linkage to exclusively focus on linking fathers to sons for the purposes of the study at hand.

3.5.2 Procedure

3.5.2.1 Preliminary overview

As an initial step, this chapter presents descriptive relationships among selected economic and demographic variables, with an emphasis on male household head birth order and sibship size.

The dissertation employs slaveholdings as a proxy measure of overall agricultural wealth in the Stellenbosch district; similar to Guelke and Shell (1983), Fourie (2011) and Martins (2019). The slaveholdings was the major labour source in Stellenbosch. Slavery took precedence, since free labour was initially not available in the colony (De Kock, 1924:36). Given the associated economies of scale, the larger the farming venture in Stellenbosch, the larger that farming venture's slaveholdings would have been. This chapter therefore presents the average slave ownership per siblingship size and birth order combination in cross-classification tables as a preliminary step.

3.5.2.2 Survival analysis

In the Cape Colony, either households leave for a district other than Stellenbosch, or the household dissolves upon death of a household head. Death dates are used to distinguish the

former from the latter. It is vital not to assume that a settler who dropped out of the sample is because of migration, if in fact it had been due to that settler's death. If it were erroneously assumed that a settler that disappeared from the tax records migrated instead of having died, it would lead to biased estimates.

This chapter relies on survival analysis to model the likelihood of leaving the district panel conditioned on selected variables. Survival analysis is an approach best suited to analyse the occurrence of a particular event at various points in time. Cleves, Gutierrez, Gould and Marchenko (2010:2) note that the major problem of using an approach like Ordinary Least Squares (OLS) regression to model the occurrence of an event is that it makes the strong assumption that the distribution of residuals is normal. The normality assumption of residuals may not necessarily hold, and survival analysis is useful in accounting for this possibility.

The dissertation estimates a complementary log-log survival model given the discrete time intervals of the panel. The complementary log-log model is not only founded in the proportional hazards assumptions like the Cox model, but it is also useful when dealing with data in which the survival times are not measured more accurately than at interval level. Estimates of the complementary log-log model are expected to be quite similar to that of the continuous Cox proportional hazards model. For this dataset, only years of exit are available and not exact months or days. The complementary log-log model is, therefore, more appropriate.

The complementary log-log survival model can be expressed algebraically as follows:

$$\Pr(y_j \neq 0|x_j) = 1 - \exp\{-\exp(x_j\beta)\} \quad (1)$$

where $F(z) = 1 - \exp\{-\exp(z)\}$.

Equation (1) is the basic form of the complementary log-log model. It allows estimation of the probability of a specific outcome occurring given a set of control variables. Naturally, the dependent variable is binary, where 0 would indicate failure of an outcome occurring and 1 a successful outcome occurrence. y_j is the associated event being modelled on subject j. x_j is a control variable on which the occurrence of event y_j is conditioned.

In the study at hand, the outcome variable is an exit from the particular district panel and the particular specification is as follows:

$$\Pr(exit_i = 1) = F(\beta_0 + \beta_1 Birth\ Order_i + \beta_2 DUM(Name)_i + \beta_3 Birth\ Count_i + \beta_4 Household\ Size_i + \beta_5 Slaves_i + \beta_6 HHI_i + \beta_7 Vines_i + \beta_8 Cattle_i + \beta_9 Sheep_i) \quad (2)$$

where $F(z) = 1 - \exp\{-\exp(z)\}$.

In Equation (2) $Birth\ Order$ is the variable capturing the birth ranking of a household head, $DUM(Name\ Inheritance)$ are dummy variables capturing whether or not a household head inherited a name from their father and $Birth\ Count$ denotes the size of a household head's sibship. The model also includes several economic variables controlling a household's level of agricultural operations and wealth. $Household\ Size$ captures the size of the households being observed. $Slaves$, $Vines$, $Cattle$ and $Sheep$ denotes the number of various historical assets classes owned by a settler household, whereas HHI is the abbreviation for the Herfindahl-Hirschman Index and measures the level of diversity in a household agricultural production diversity calculated from PCA.

Concerning the control variables, *a priori* expectations are for larger households to be less likely to migrate given that they are more mature family units. The parents of the household would have already established themselves in the district for the long-term before deciding to start with a family. The author expects the four variables representing agricultural wealth to have a positive influence on households' migratory tendencies. For the Stellenbosch district being observed in this chapter, slaveholdings and vines should be more significant in explaining settler household persistence given the relative economic importance of these variables compared to other agricultural assets. Household production diversity should have a positive relationship with likelihood to persist in the district. Households that are hedged in terms of their agricultural production are more capable in weathering negative market shocks to any one agricultural output.

Apart from the birth order, compounded by size of the siblingship being observed for its potential effect on likelihood to migrate, this chapter sets out to rule out kinship structures and the effects of naming a child after kin, as a significant determinant on the likelihood of exiting the district. There is sufficient reason to believe that either birth order or name inheritance may have led to migratory decisions. Given a possible relationship between birth order and naming conventions, the birth order effect may already be captured by naming conventions. This research sets out to determine if this is the case and if it is possible to dismiss personality

differences induced by sibship and naming conventions as explanations for migration out of the Stellenbosch district.

3.6 Results

3.6.1 Descriptive evidence

Table 3-9 in Appendix D provides a summary of the sibship characteristics of heads of settler households present in the Stellenbosch district. In proportional terms, first- and second-born brothers from larger parental households appear to have been the most prevalent in this district.[55] This pattern provides an early indication that those born earlier are more likely to stay in the same district as their parents.

In exploring the possible differences that may exist among siblings, this chapter also explores sibship position and wealth status. Table 3-2 tabulates the average number of slaveholdings at various ages, sibling count and birth order combinations.[56] Settlers who were the only sons, generally had greater slaveholdings in their earlier life. A possible explanation for this is that they were bequeathed most of their father's riches as the only male child.[57] If more brothers were present, wealth was subdivided among several siblings. Male offspring in their middle age, born earlier to larger brother sibships caught up to an extent with their counterparts.[58] Brothers that were born first and to households with fewer number of male siblings, generally tended to have larger slaveholdings. This could be attributed to subdivision of assets and, therefore, emphasise the important role that inheritance played in wealth accumulation. Settler sons were able to amass wealth early on, due to either the Roman-Dutch law of inheritance, or

[55] The subjective turn of phrase of "larger", simply refers to households with more children, say more than five male siblings.

[56] As an empirical curiosity, this enables analysis of whether life cycle effects are different for various brother birth order and sibship size combinations. Personality differences common to male siblings born in the same order, may manifest itself as a similar speed of wealth accumulation. From the birth order literature, firstborns are argued to be more traditional and aligned with their parents in terms of ideology, whereas younger-born siblings are suggested to be more extraverted. The personality differences could further manifest itself as a willingness to adopt more risky agricultural strategies or be more trusting of strangers, both of which could have an effect on the agricultural output in the largely agrarian society of Stellenbosch.

[57] Here it is important to refer to Table 3-9 in Appendix D which presents cross-tabulations of average slaveholdings with the number of brothers in the left vertical column and total number of siblings in the horizontal rows. Settlers from large parental households and in which there were fewer male offspring, were generally better endowed in terms of slave ownership. This verifies the belief that sons inherited most of their fathers' estates. More male offspring would consequently imply a dilution of their parents' estate upon inheritance. Intuitively, if a settler had fewer male siblings to compete with, they would have started off their adult life with a larger inheritance.

[58] Here middle age refers to individuals in the 45 to 55 years of age range.

the fathers' testaments (De Kock, 1924). The fewer brothers there were to dilute the father's estate, the better endowed the male offspring were in adulthood.

Table 3-2 Average slaveholdings per household per age group, Stellenbosch, 1775 to 1844

Age 25						Age 35					
Birth Order	**1**	**2**	**3**	**4**	**5**	**Birth Order**	**1**	**2**	**3**	**4**	**5**
Count						**Count**					
1	3.48					**1**	7.71				
2	2.50	2.30				**2**	5.00	4.56			
3	3.21	1.35	1.17			**3**	8.41	7.09	6.00		
4	2.26	1.93	1.24	2.85		**4**	5.03	5.46	5.43	6.45	
5	2.12	0.95	1.26	1.63	3.38	**5**	4.30	3.35	6.15	3.71	5.05
6	2.33	3.40	2.35	2.65	3.63	**6**	4.88	5.94	4.05	5.56	8.56
7	1.69	1.73	2.57	2.00	2.56	**7**	6.36	6.47	4.71	4.33	7.07
8	1.80	1.11	4.38	4.30	3.40	**8**	4.08	3.58	16.14	10.91	11.75
9	0.00	2.00	8.00	2.00	4.00	**9**	3.00		0.00	4.00	6.00
Age 45						**Age 55**					
Birth Order	**1**	**2**	**3**	**4**	**5**	**Birth Order**	**1**	**2**	**3**	**4**	**5**
Count						**Count**					
1	8					**1**	8.55				
2	5.09	7.32				**2**	7.89	24.33			
3	10.04	5.93	8.23			**3**	6.48	7.80	8.11		
4	5.67	7.35	8.05	9.43		**4**	8.71	10.00	7.08	14.67	
5	6.19	9.77	6.57	6.33	6.64	**5**	12.77	12.07	15.13	9.14	5.13
6	14.06	12.64	5.19	9.47	7.31	**6**	17.50	4.82	6.30	10.60	12.38
7	9.50	10.89	10.71	5.44	9.88	**7**	12.33	12.50	4.00	7.83	14.60
8	10.80	7.56	15.67	8.30	3.00	**8**	8.00	3.00	27.25	6.00	11.00
9	4.50	13.50		27.33	8.00	**9**	5.00			1.00	17.00

As expected, brothers in later stages of the lifecycle tended to have larger slaveholdings on average. In later years (age forty-five and older), brothers born first to a sibship with more male offspring, surpassed their counterparts from parental households which had fewer male offspring in terms of slaveholdings. This could potentially be attributed to explanations from the sibship literature – either the theory sibling rivalry theory of Adler (1927, 1928) or the Darwinian evolutionary psychology literature aligned with Sulloway (1996). Alternatively, this could be explained by the limited supply of land on which to employ slaveholdings in productive agricultural activities. This is beyond the scope of this chapter, however. Siblings from larger sibships had to learn to compete for parental resources and care from a young age. Translating this to the level of wealth held in adulthood, a similar pattern emerges.

Older settlers who focused on farming, had more time in which to acquire slaveholdings across their lifecycle, compared to younger settlers.

Table 3-3 presents the average vines owned per sibship size and birth order combination at selected ages. Results are comparable to that of slave ownership. At earlier ages there is a tendency for earlier-born brothers of smaller brother sibships to own more vines. The substantial differences, however, tend to dissipate toward the end of the lifecycle. Firstborns of larger sibships owned at least as much vines as those from smaller sibships earlier on in their lifecycles. This result, along with that of slaveholdings, confirms to an extent the sibship literature for firstborns that were more affluent later in adulthood. This effect, in line with the literature, appears to be more pronounced among larger sibships.

Table 3-3 Average number of vines owned per household per year, Stellenbosch, 1775 to 1844

Age 25						Age 35					
Birth Order	**1**	**2**	**3**	**4**	**5**	**Birth Order**	**1**	**2**	**3**	**4**	**5**
Count						**Count**					
1	15320					**1**	14271				
2	7000	4450				**2**	16444	13406			
3	5880	1722	1471			**3**	15774	19939	11571		
4	6936	3000	8494	4889		**4**	15563	10933	12424	10833	
5	8276	714	4182	5000	7364	**5**	16654	7727	15800	22500	16684
6	5435	15000	8125	9000	12063	**6**	12750	14471	17347	13643	33200
7	5231	6214	4914	5167	8333	**7**	17692	25214	14333	23167	18667
8	28000	1429	10000	7500	16000	**8**	8167	12273	48000	20000	15000
9	0	16000	60000	8750	30000	**9**	10000			30750	30000
Age 45						**Age 55**					
Birth Order	**1**	**2**	**3**	**4**	**5**	**Birth Order**	**1**	**2**	**3**	**4**	**5**
Count						**Count**					
1	17283					**1**	8333				
2	10100	18654				**2**	11722	26875			
3	8619	20533	16222			**3**	12200	29111	12857		
4	14211	20333	26833	27857		**4**	8333	30455	12462	20000	
5	16253	23333	21273	12818	20000	**5**	17500	26750	28500	18286	19125
6	31556	26385	14538	7000	18708	**6**	10727	10700	10000	34480	29571
7	103636	42	29286	7000	16857	**7**	36667	7800	0	10000	31250
8	28750	22857	45500	16500	5667	**8**	30000	3333	93750	3000	0
9	0	4500		113333	100000	**9**	0			130000	100000

The opposing hypothesis to the familial ties or loyalty effect between parent and offspring determining migratory decisions, is whether birth order, through the agricultural wealth mechanism, plays a significant role in determining a settler household's migration from Stellenbosch.[59] Tables 3-2 and 3-3 show that birth order and sibship size are related to the level of wealth owned and this could explain persistence.

An important disclaimer, however, is the possibility that the average tabulated in Tables 3-2 and 3-3 is potentially unreliable for certain sibsip size and birth order combinations given the small sample sizes associated with calculating the averages. Table 3-4 illustrates these sample sizes. While the relationship identified between sibship and birth order is, therefore, promising, the small sample sizes when age is controlled for in table format necessitates further analysis both to establish the determinants of migration and wealth ownership.

Table 3-4 Sample size for use in calculation of agricultural asset averages, 1775-1844

Age 25						**Age 35**					
Birth Order	**1**	**2**	**3**	**4**	**5**	**Birth Order**	**1**	**2**	**3**	**4**	**5**
Count						**Count**					
1	29					**1**	35				
2	32	23				**2**	30	32			
3	29	20	18			**3**	34	35	16		
4	31	29	34	20		**4**	35	35	37	22	
5	33	21	23	19	24	**5**	27	26	27	28	22
6	27	20	20	17	16	**6**	33	18	22	16	16
7	16	15	7	13	9	**7**	14	15	14	15	14
8	5	9	8	10	5	**8**	13	12	7	11	4
9	2	3	1	5	1	**9**	3		1	5	1
Age 45						**Age 55**					
Birth Order	**1**	**2**	**3**	**4**	**5**	**Birth Order**	**1**	**2**	**3**	**4**	**5**
Count						**Count**					
1	23					**1**	11				
2	23	28				**2**	19	9			
3	23	15	22			**3**	21	10	9		
4	27	20	22	14		**4**	7	12	13	6	
5	21	26	14	12	14	**5**	13	14	8	7	8
6	18	14	16	15	13	**6**	12	11	10	10	8
7	12	9	7	9	8	**7**	6	6	1	6	5
8	10	9	9	10	3	**8**	5	3	4	6	1
9	2	4		3	2	**9**	1			1	1

[59] This chapter also examines whether there are direct connections between a settler's likelihood to migrate and their sibship characteristics. As Miller and Maruyama (1976) argue, sibship characteristics may influence personality traits like extraversion and sociability, both of which may be contributing factors toward a settler's likelihood to undertake a risky endeavour, such as migrating out of your relatively stable and safe community (Silventoinen, Hammar, Hedlund, Koskenvuo, *et al.*, 2007; Jokela, 2009; Canache, Hayes, Mondak, *et al.*, 2013).

Figure 3-1 illustrates the make-up of the Stellenbosch district concerning birth order. The key of the plot is interpreted from the perspective of the male offspring household. Households are distinguished from the number of male siblings they have. Approximately a quarter of all residents in Stellenbosch across all years were first-born male children.[60] This constitutes a significant portion of the population.

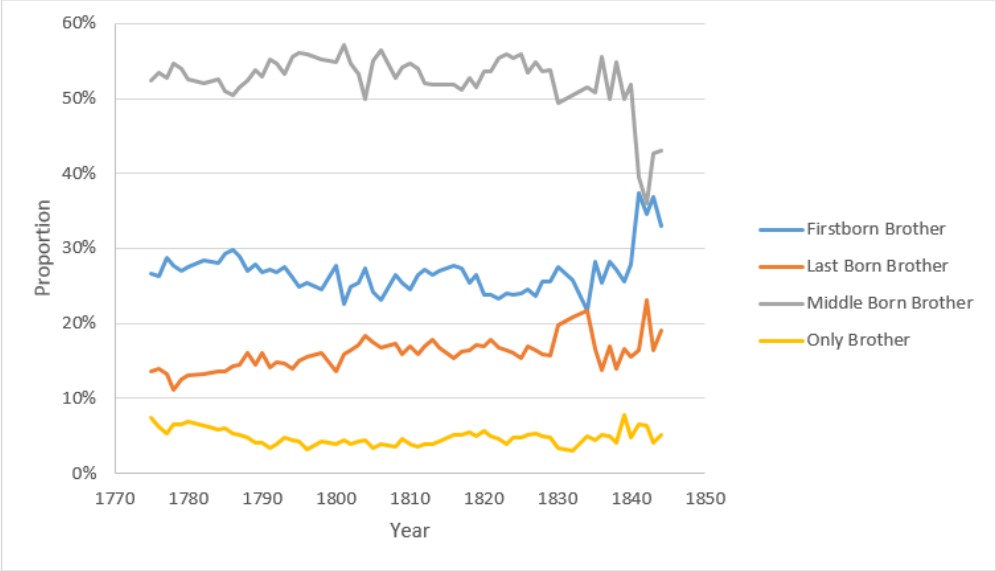

Figure 3-1 Share of sons present in the Stellenbosch district disaggregated by brother birth order group , 1775-1844

The 'middle-born' subgroup is the single largest group of people residing in Stellenbosch but includes all individuals who were not first or last born. Figure 3-1serve as a potential early indicator of personality being determined by birth order, consistent with the evolutionary psychology literature of Sulloway (1996) and the psychoanalytic literature of Adler (1928) – at least as far as likelihood to migrate is concerned. Firstborns are more conservative and traditional. They are, therefore, less likely to do something as risky or unconventional as migrating, relative to last-born brothers. The greater proportion of first-born settlers in Stellenbosch could also be explained by inheritance practices if they were most favoured, however. Further analysis of birth-order effects and migration is, therefore, required. Those settlers that were the only male child in a settler household comprise but a small portion of only five percent of the total population. This small share is a potential indicator of migration of those that were less well endowed with agricultural riches.[61] Alternatively, it could suggest that

[60] This chapter controls for those cases where there was only one brother in a family – these cases are demarcated as 'Only Child' in the plot. Therefore, the cases captured in the 'First-born' birth group truly represent those brothers born first to a sibship that has at least two male offspring.

[61] In Figure 3-1, those settlers that are only children showed a proclivity to be either non-farmers or focusing only on viticulture. With regards to the former, non-farmers would intuitively be more likely to exit the district since

there were few households in Stellenbosch with more than one male sibling. Figures 3-2 and 3-3 below present the distributions of parental household size in terms of brothers and total siblings. It informs of the change in Stellenbosch's comparison as far as its residents are concerned in terms of number of siblings in the Cape Colony.

Figure 3-2 presents the distributions of settler households residing in the Stellenbosch district by the number of male offspring in their parental household that is also now present in the Cape Colony. During the earlier part of the sample period, the largest group of settlers residing in Stellenbosch were those settlers who were the only male siblings in their parental households. Later on, however, households with a greater number of male siblings came to comprise the majority of Stellenbosch households. In fact, offspring who were the only male offspring in their parental household came to be among the lowest represented groups in Stellenbosch.

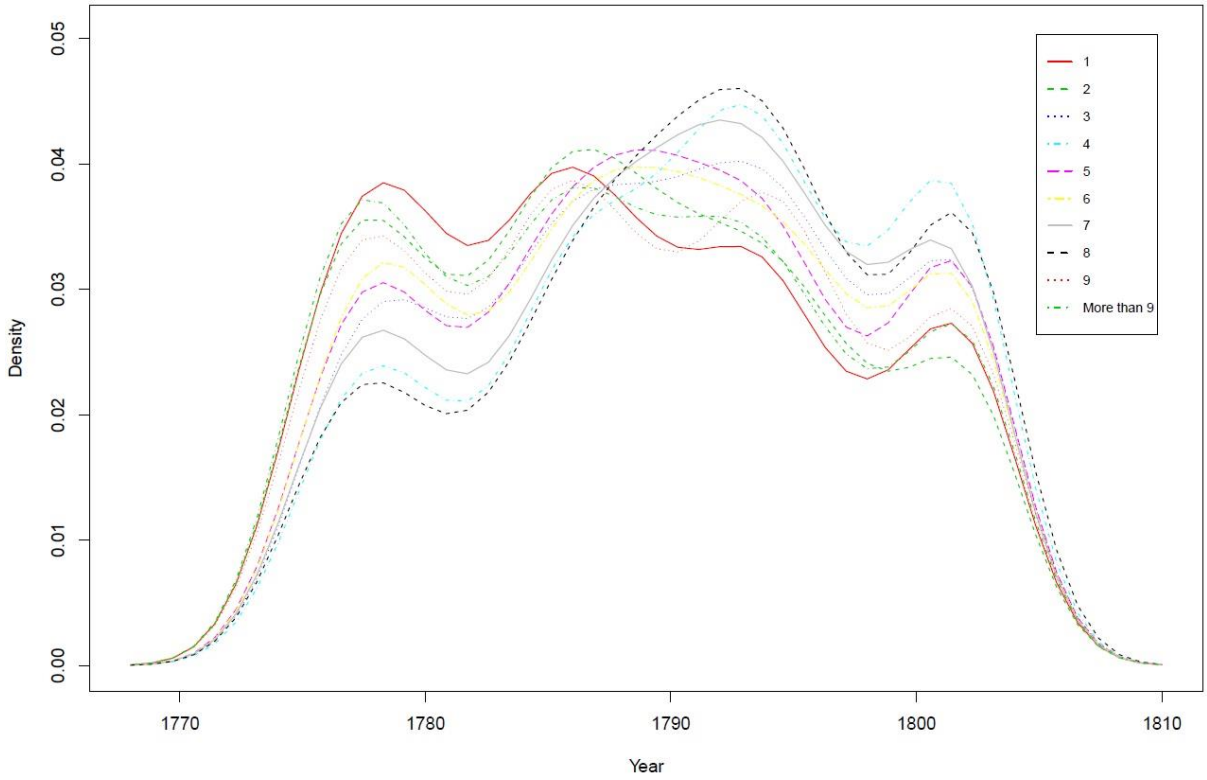

Figure 3-2 Annual distribution of settlers residing in Stellenbosch by number of male offspring, 1775-1803

Figure 3-3 illustrates the sibship size distributions of households residing in Stellenbosch whose heads were the only male siblings in their parental households. Initially, at the start of the observation period, settlers from single child parental households comprised the largest

they would have less holding them back from exiting. In the case of the latter, those specialising in a lone agricultural function would be more exposed to the market shocks and hence more likely to fail compared to those with large mixed farming operations. These scenarios contribute to the fact that there are less single child adults in the Stellenbosch district.

grouping in Stellenbosch. Later on, however, settlers who were the only male child in a household with several siblings came to be the majority in Stellenbosch. While not as apparent, it would seem that the more female siblings a single male child had in their parental household, the more prevalent they became later in the observation period. Figure 3-3 may suggest that parents invest more in their male offspring – more female offspring that a single male shares parental care and resources with, compounds this effect. Such male settlers from parental households with only one male offspring and several female siblings were more persistent in Stellenbosch. This effect is also present for household heads from parental households with multiple male siblings. Notwithstanding, it becomes necessary to determine whether birth order has any determining effect on a household's persistence in Stellenbosch. This chapter resorts to survival analysis later on to explore this possibility

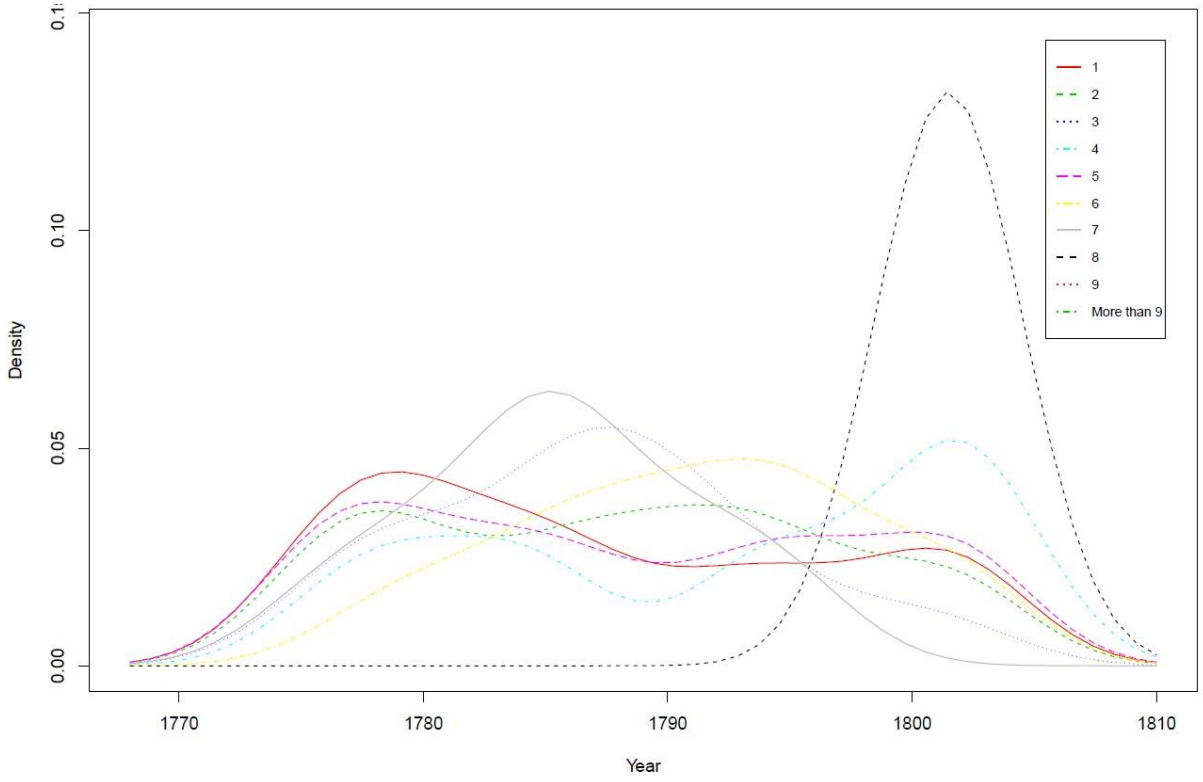

Figure 3-3 Annual distributions of Stellenbosch household heads with one male sibling in their parental household by their sibship size, 1775-1803

Table 3-3 illustrates the correlation between birth order and father name inheritance. This cross tabulation assists in understanding name inheritance patterns. These cross tabulations are a first important step in the analysis given the need to establish whether birth order may instead have cultivated familial ties or loyalty effects between fathers and sons through the name inheritance channel.

Table 3-3 of Panel A shows the proportion of sons per birth order position who had a first name that was identical to their father. The number of male offspring that had an identical first name to their father, was concentrated among brothers born in the first three positions. Beyond the third birth position, the number of sons whose first name was identical to their fathers, dissipate rapidly. Panel B illustrates the proportion of sons that inherited their first name from any of their fathers' names. The results are virtually identical.

A common thread in naming convention research is that firstborns usually inherit the names from their grandparents, while third-born children inherit their parents' names (Rossi, 1965; Barry; 1979; Otta, 1997). In the study at hand, this is the case as well. Table 3-3 reveals information concerning the naming convention present at the Cape – a subject that has not received any focus up until now. In the Cape Colony, the practice of naming a son after their father was most prevalent among third born sons. In other words, of the sons that shared a first name with their father, those who were the third male offspring were most dominantly represented in this practice. Sons who were the first and second male offspring in their parental households, in contrast, were most likely to share a first name with other older kin.

Table 3-5 Proportion of male household heads that inherited a name from their father by brother birth order, relative to the total number of sons born in that position

	Panel A **First name Identical to Father**			***Panel B*** **First name Inherited from Father**		
Brother Birth Order	No	Yes	Total	No	Yes	Total
First	510	81	591	485	106	591
	86%	14%		82%	18%	
Second	410	120	530	396	134	530
	77%	23%		75%	25%	
Third	280	121	401	267	134	401
	70%	30%		67%	33%	
Fourth	236	37	273	231	42	273
	86%	14%		85%	15%	
Fifth	173	12	185	173	12	185
	94%	6%		94%	6%	
Sixth	99	9	108	99	9	108
	92%	8%		92%	8%	

Tables 3-13 and 3-14 in Appendix G provide more detail concerning intergenerational name inheritance between grandsons and both their paternal and maternal grandfathers. Table 3-13 illustrates the proportion of all settlers in the sample, for which links with fathers in the SAF could be established, which inherited a name from their paternal grandfather. The table plots these proportions conditioned on brother birth order and year. It is apparent that firstborn sons would usually have inherited the name of their paternal grandfather.

The naming convention patterns are not as clear when observing Table 3-14. This table plots the proportion of grandsons that inherited a name from their maternal grandfather. There was no dominant naming practice as was the case with firstborn sons. There appears to be a weak positive relationship between second born sons and maternal grandfather name inheritance. Of the grandsons that inherited a name from their maternal grandfather, those that were born second were the most likely to have inherited this name. The proportion increases towards the end of the sample period, as is the case in Table 3-13 as well. This could be an indicator of greater geographic persistence among settlers that inherited a name from elder kin.

Figure 3-4 illustrates the distribution of settler household heads that inherited their father's names across time. There is no significant differences in the distributions. This preliminary plot casts some doubt on the hypothesis that settlers who inherited names from their father exhibited a loyalty effect in their persistence in Stellenbosch. With all of the distributions for those who did not share a name with their father or shared either a first- or middle name, exhibiting a similar shape, there is no apparent significance of name inheritance in settlers' migratory decisions. Conducting survival analysis should confirm this insignificant relationship.

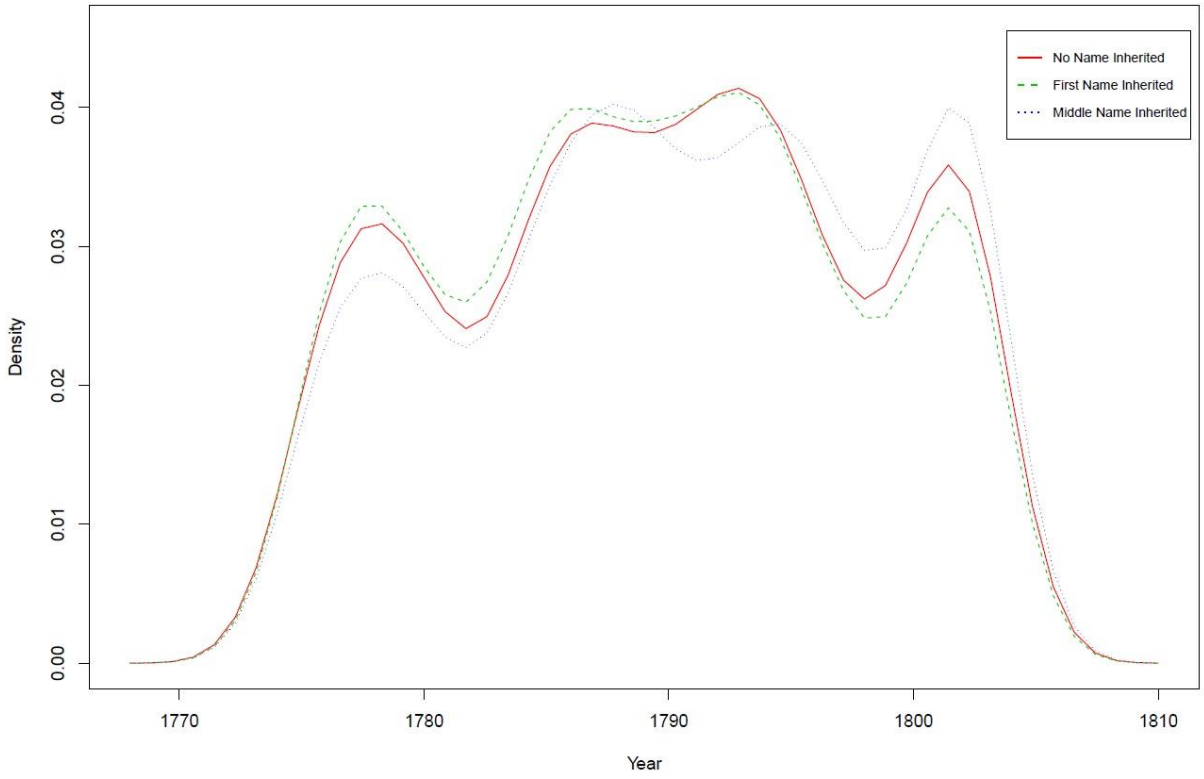

Figure 3-4 Annual distribution of settler households residing in Stellenbosch grouped by name inheritance, 1775-1803

Likewise, panel (a) of Figure 3-5 illustrates that the proportion of household heads in Stellenbosch that share a name with their father comprises a consistent 30% across all years. Those who shared no name with their father made up 70% of all households residing in the district on an annual basis. When testing for name inheritance between the son and either the paternal grandfather or father, the results of Figure 3-5's panel (b) report an even greater proportion of sons that are subject to the practice of intergenerational name inheritance. When testing for both name inheritance from fathers and paternal grandfathers, sons with no inherited names fall to below 60% of all sons observed annually. Those that have an inherited name increase to 40% of sons with observed fathers and paternal grandfathers in the SAF. There appears to be a marginal increase across time for those sons that inherited a name from either their father or grandfather. The practice of name inheritance in the Cape, therefore, appears to be relatively widespread.

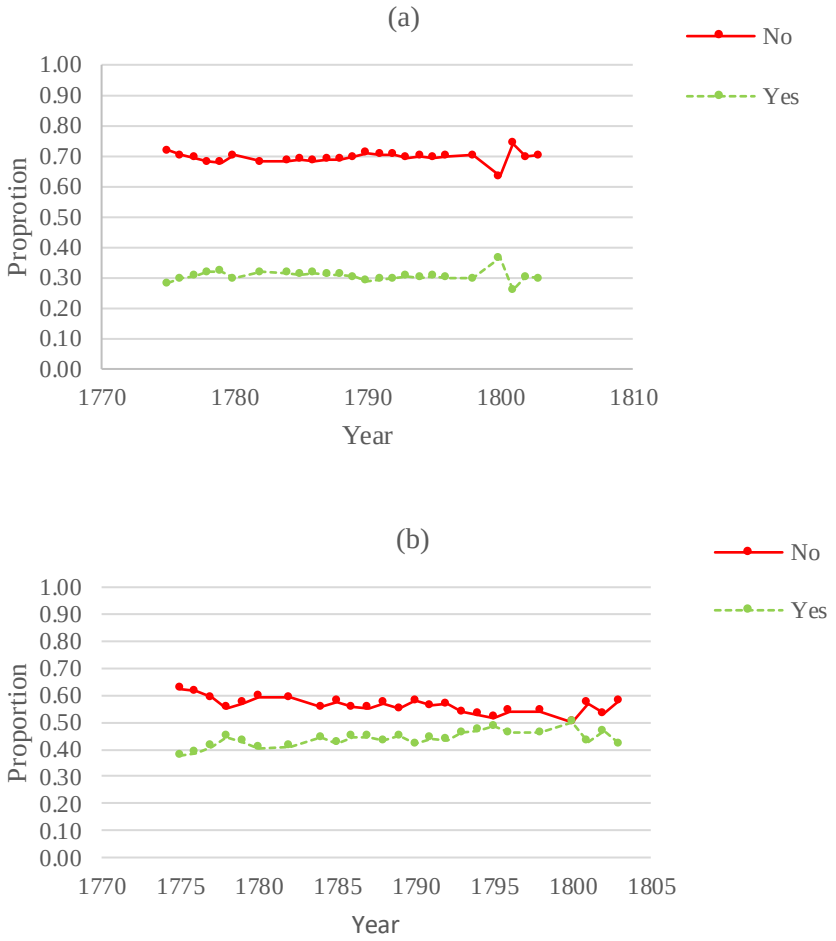

Figure 3-5 Proportion of household heads residing in Stellenbosch that shared any name with their father (top panel) and either father or paternal grandfather (bottom panel), 1775-1803

The following section presents results from survival analysis to explore the major determinants for settler households persisting in Stellenbosch. As a preliminary step, the dissertation examines which type of agricultural function translated into practicing households persisted in the district for longer.

3.7 Survival analysis

As an introductory step in this survival analysis section, the chapter examines the role of different agricultural functions in determining households' migratory patterns and the influence of changing land tenure regulations in 1813. Figures 3-6 and 3-7 compare the Cox Proportional Hazard plots for particular agricultural functions before and after 1813, to analyse the influence that new, more secure, land legislation might have had on the proclivity to persist in or migrate from the district.

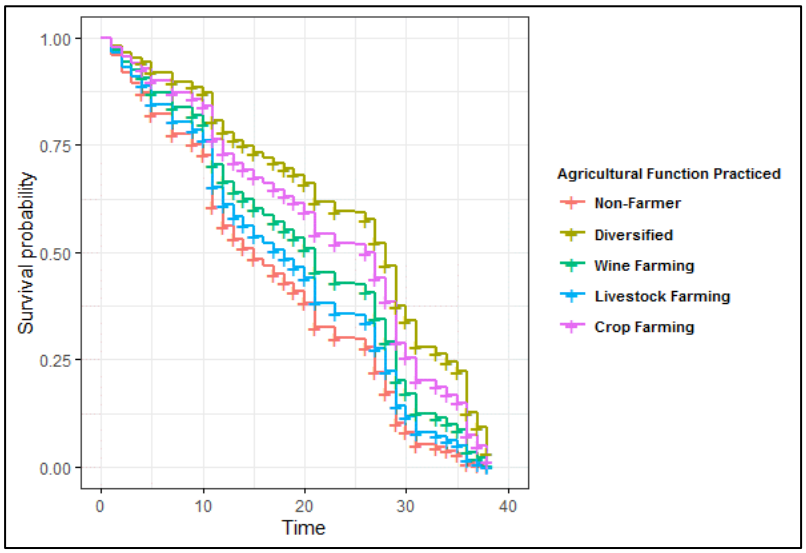

Figure 3-6 Cox Proportional Hazard plot conditioned on various agricultural functions prior to the ratification of the perpetual quitrent land tenure system in 1813

The Cox Proportional Hazard plots in Figure 3-6 are for the period prior to the introduction of the perpetual quitrent system. The most diversified households in terms of agricultural production, are the most likely to persist for longer periods. In the event of a market downswing in any particular agricultural output, it would have been prudent for settlers to have alternative markets as hedge against market shocks. Households focusing on one activity, for instance, were inadequately hedged against such shocks. Having a diversified production base was, therefore, a risk-mitigating mechanism. Those households with no agricultural assets were more likely to remain in the district for shorter periods, since they did not have any assets binding them to the district. In households that practiced activities in which land was the major

factor of production, crop farmers and viticulturists were the second and third least likely to exit the district.

The Cox Proportional Hazard plots for the period after 1813, shown in Figure 3-7, exhibits minor differences. Non-farming settler households were still more likely to persist in the district for shorter periods. Those households practising mainly wine farming, however, are the most likely to persist for longer periods in Stellenbosch. Following 1813, the year marking the amendments in the land tenure system, the significant differences among various agricultural production functions mostly disappeared as *de jure* property rights became more secure.

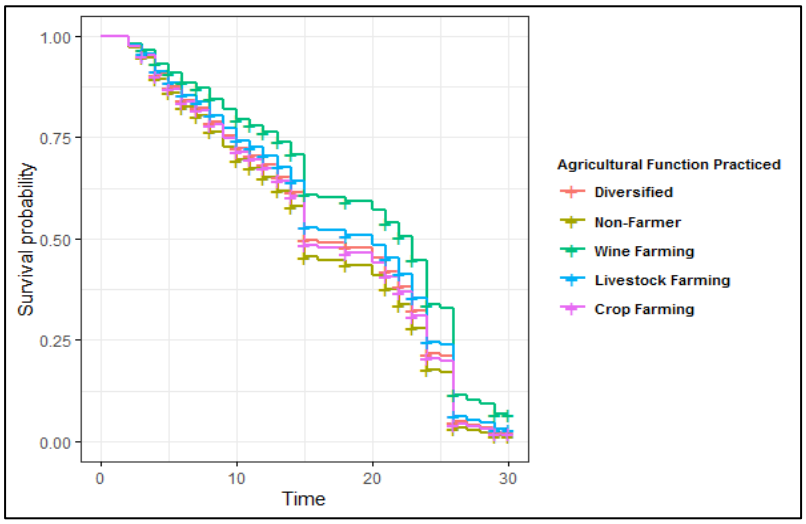

Figure 3-7 Cox Proportional Hazard plot conditioned on various agricultural functions after the ratification of the perpetual quitrent land tenure system in 1813

Figure 3-8 presents the Cox Proportional Hazard model plot conditioned on the position in which a settler household head was born relative to his brothers. Before the amendments to land ownership regulations, there was a significant difference in terms of the likelihood to drop out of the district panel and birth position.[62] Settlers that were born later were more likely to drop out of the district panel. There was an insignificant difference, in contrast, between household heads that were born first, fourth and earlier or sixth and earlier. The sizable differences among likelihood to 'exit' for different birth positions dissipate in the period after 1813. Naturally, apart from land tenure amendments, such as those in 1813, other variables

[62] The sample is split here at 1813, given the amendments to the land tenure system and its possible impact on the inheritance that earlier-born sons received relative to their younger counterparts. Now that it was possible to bequeath land to your descendants, the change in the land tenure system may have seen eldest sons receiving a significant injection to their estate upon receiving their inheritance. It is important to note the left hand graph only observes settlers that remained in the sample until 1813. The right hand graph observes only settlers that were present from 1814 onward. This approach provides a preliminary indication of whether the significant change in land ownership regulations had any impact on the behaviour of inhabitants, given their birth position.

would also have had an influence on a settler household's likelihood to migrate. This section explores these alternative determinants further.

Prior to the amendments in the land tenure system, later born households dropped from the district panel after a short period. There was less persistence among younger brothers. Brothers born earlier, in contrast, were more likely to persist for longer periods. Although disputed by recent research, younger brothers were likely more extraverted and, consequently, open to new and potentially risky experiences. They were, therefore, more likely to be migrants outside of the district and potentially further away from their parents. Alternatively, it could simply have been a function of inheritance. Older sons were more favoured to inherit more handsomely, compared to their younger male siblings. The literature on Dutch practices as far is primogeniture and multigeniture are concerned, is deficient (Alston and Schapiro, 1984).

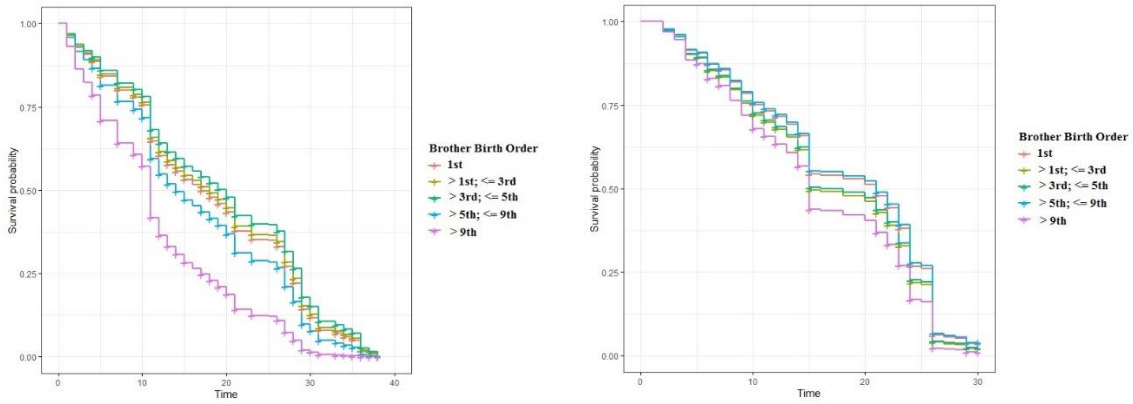

Figure 3-8 Cox Proportional Hazard Model Plot of the settler household persistence in the Stellenbosch district conditioned on brother birth order before (left) and after (right) 1813

After the amendments to the land tenure system, the slopes on the hazard functions of all birth order groups were similar. This suggests that once property rights became more secure, birth order played a less significant role in determining a settler household's 'exit' from the district. All settler household heads, regardless of their parental household social environment, drew equal benefit from the amendments to the land tenure system.

In the next step, the empirical strategy conditions the Cox Proportional Hazard models on father name inheritance in Figure 3-9. The parameter of importance is whether sons inherited any of their names from their fathers.

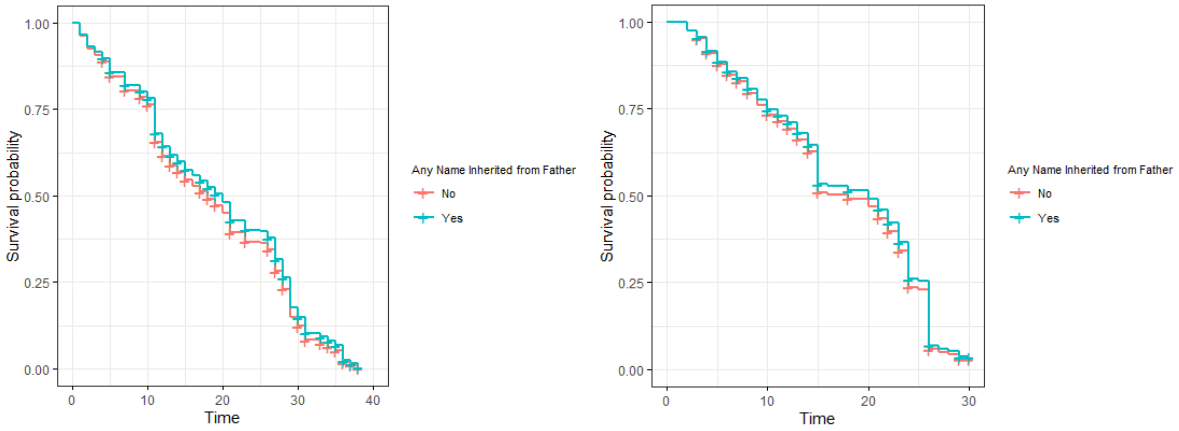

Figure 3-9 Cox Proportional Hazard model plot of settler household persistence in the Stellenbosch district conditioned on name inheritance from father before (left) and after (right) 1813

The relationship between name inheritance and likelihood to persist is marginal at best. Those settlers that inherited a name from their father are slightly more likely to persist for longer than those who inherited no name at all. The birth order effect is much more substantial, at least at first glance, than the naming convention effect. Conducting parametric survival analysis in the latter part of this section permits distinguishing between the significance of these effects in determining migratory decisions. Moreover, it allows for determining whether the overlap between naming conventions and sibship favours the one determinant above the other – if estimation does not allow dismissal of personality differences as a driver of migratory decisions entirely.

Results from complementary log-log survival model estimation follow. An important caveat for the models is that they consider the period from 1775 until 1803 alone. The reason is that after 1803 until 1806, a Batavian government presided over the Cape before the British assumed administrative power. These changes in regimes could have had significant influences on recordkeeping practices that would have led to biased estimates. Assuming that a prolonged or definitive absence from the panel marks migration, changes in recordkeeping between two different governments as well as changes in district boundaries, would have significant negative effects on producing unbiased estimates. The preliminary plots were useful to provide a general picture of the relationship between sibship, naming conventions and migration. The models below provide detailed estimates.

Table 3-6 Complementary Log-Log Survival model of settler households located in the Stellenbosch district for the period 1775 to 1803

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variables	*Exit*	*Exit*	*Exit*	*Exit*	*Exit*	*Exit*	*Exit*	*Exit*	*Exit*
Brother Birth Order (Grouped)	0.03			0.04	0.04	0.05**	0.05**	0.06**	0.06**
	(0.02)			(0.03)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
DUM(First name identical to father)		0.06			0.10				
		(0.10)			(0.11)				
DUM(First name inherited from father)			0.07	0.11					0.13
			(0.10)	(0.11)					(0.11)
DUM(Any name inherited from father)								0.10	
								(0.11)	
Number of Brothers (Grouped)				0.00	0.00	-0.01	-0.01	-0.01	-0.01
				(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age						0.02	0.02	0.02	0.01
						(0.02)	(0.02)	(0.02)	(0.02)
Age^2						0.00	0.00	0.00	0.00
						(0.00)	(0.00)	(0.00)	(0.00)
ln(Settlers)						-0.13*	-0.13*	-0.13*	-0.13*
						(0.08)	(0.08)	(0.08)	(0.08)
ln(Slaves)						-0.35***	-0.35***	-0.35***	-0.35***
						(0.06)	(0.06)	(0.06)	(0.06)
ln(Wine)						-0.08	-0.08	-0.08	-0.08
						(0.06)	(0.06)	(0.06)	(0.06)
ln(Cattle)						0.11***	0.11***	0.11***	0.11***
						(0.04)	(0.04)	(0.04)	(0.04)
ln(Production Diversity)						-1.64***	-1.64***	-1.64***	-1.64***
						(0.24)	(0.24)	(0.24)	(0.24)
Constant	-1.87***	-1.79***	-1.79***	-1.91***	-1.91***	-2.21***	-2.21***	-2.25***	-2.24***
	(0.14)	(0.12)	(0.12)	(0.15)	(0.15)	(0.46)	(0.46)	(0.46)	(0.46)
Observations	9,049	9,070	9,070	9,049	9,049	9,049	9,049	9,049	9,049
Number of Households	1,188	1,190	1,190	1,188	1,188	1,188	1,188	1,188	1,188
Year Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: *** p<0.01, ** p<0.05, * p<0.1
Standard errors in parentheses

Table 3-6 presents the complementary log-log survival model of Stellenbosch for 1775 (the start of the observation period) until 1803 (the first year in which the Colony was administered by the Batavian government). An important caveat is that the estimates comprise all households that were present in the linked sample during this period. This included households whose death years were not present in the SAF dataset. This approach is discussed in the following subsection. For now, the focus is on the results presented in Table 3-4. The major variables of interest are the top four variables: *Brother Birth Order (Grouped)*; *First name identical to father*; *First name inherited from father;* and *Any name inherited from father*. The analysis yields a significant and positive coefficient on the birth order variable. Younger brothers were more likely to migrate. Whether a son inherited a name from his father, in contrast, is not significant in explaining 'exit' from Stellenbosch – despite having the expected sign. The literature on naming conventions, suggest that there was the potential for a 'loyalty' effect built around kinship and familial ties to have been at stake in an offspring's decision to migrate or persist. Since the literature on naming conventions argue that parents name their offspring after kin for which they have the highest regard, this offspring may potentially have been favoured in terms parental resources and care. This favoured treatment would then have given way to the offspring with inherited names to exhibit some level of loyalty toward their parents. This was not the case, however. Instead, it was birth order that played a more significant role in this decision process – even though the practice of naming children after elder kin in the Stellenbosch district of the Cape Colony appeared to be quite prevalent.

As far as *a priori* expectations are concerned, the size of the birth order effect is more consistent with the modern literature suggesting a small effect of birth order on socioeconomic outcomes. It stands in contrast with the more dated literature suggesting substantial birth order effects on socioeconomic outcomes.

The control variables in the form of slave ownership (*ln(Slaves)*), wine supply (*ln(Wine)*), cattle ownership (*ln(Cattle)*) and production diversity, are the major variables that exhibit a significant relationship with the likelihood of a household exiting the district. The wealthier a household was in terms of dominant production inputs and assets (slaveholdings and wine supply), the less likely they would have been to 'exit' the district. This result points toward an economy that was still expanding with some opportunity for wealth-generation for those settler households with the most resources to do so. Economic status was consequently a significant determinant of geographic persistence.

Households who had more cattle were more likely to exit, however. The more cattle a settler household owned the larger tract of grazing pasture was required. Population growth in Stellenbosch implied that less land was systematically available for pastoralists. Those requiring larger tracts of land would have opted to migrate to the less-populated regions of the colony where grazing land was in greater supply. Even after the introduction of the perpetual quitrent system in 1813, households specialising in livestock farming would have been less inclined to convert the land held under loan-lease to perpetual quitrent (De Kock, 1924). There was a tendency among pastoralists to move about as their cattle holdings grew and they needed larger tracts of pastoral land and water supplies. De Kock (1924), in addition, asserts that pastoralists had a proclivity to prefer loan agreements. Loans were more convenient. It allowed settlers to reside on a particular plot of land until their livestock holdings grew large enough, after which they opted to migrate. The findings for the *ln(Cattle)* coefficient in Table 3-6 confirm this behaviour.

Finally, among the control variables is a variable measuring how diverse a settler household's production base was. This variable takes on the form of the Herfindahl-Hirschman Index. The greater the index value was, the more diverse a household's production output. The coefficient on this variable was large and statistically significant. This is evidence that those settlers with a wider set of agricultural production outputs were more likely to persist. Negative shocks to any one agricultural industry in the form of market slumps, due to oversupply, price controls or export tariffs, would have had a greater negative impact on less diversified households.

Before it is possible, however, to dismiss personality as a major determinant of migratory decisions among settlers in the Stellenbosch district for certain, it is necessary to consider the relationship between agricultural wealth and siblingship characteristics. Agricultural wealth may indeed be the major determinant of a household's migratory decisions from the district. Birth order and naming practices inducing personality driven migration, contrary to older literature suggesting significant effects on adult economic outcomes, at best played a minor role in households' departure from the Stellenbosch district of the Cape Colony. To confirm this dissertation conduct further analysis in determining whether birth order or naming practices play a significant role in determining a settler household's level of agricultural wealth.

Table 3-7 presents results testing whether birth order or name inheritance determined a settler household's level of agricultural wealth. In line with Guelke and Shell (1983), Fourie (2011) and Martins (2019), this chapter regards slaveholdings as a major productive asset and a robust

indicator for overall agricultural wealth in the largely slave-driven economy of Stellenbosch. Table 3-7 includes the natural logarithm of birth order as a determinant of the natural logarithm of slaveholdings. Interpretation follows as the sensitivity of changes in wealth with a change in birth order. Alternatively, Table 3-12 models birth order in levels as a determinant of the natural logarithm of slaveholdings. In this table, interpretation is simpler even though the crux of the results is identical to those presented in Table 3-7. Specifically, in Table 3-7 birth order is interpreted as the percentage change in wealth for a unit change in birth order.

Table 3-11 in Appendix F presents models using cattle as wealth proxy as well – as robustness check. Results returned for cattle as wealth proxy are comparable to the results using slaveholdings instead. Using vines as wealth proxy yielded no significant results.

There is a statistically significant relationship between brother birth order and the level of wealth of a settler household, as proxied by slaveholdings. The relationship also remains mostly consistent, regardless of the type of effects introduced to the model. This finding suggests that there is evidence of birth order as a significant determinant of the level of agricultural wealth. The later a brother was born in his sibship, the less his agricultural wealth would have been. This is consistent with literature focusing on modern societies, which suggests greater academic and career performance among individuals born earlier. The findings presented, echo that of Gibson and Gurmu (2011) that also find an inverse relationship between birth order and land ownership and agricultural productivity.

There is a significant negative relationship between the paternal name inheritance dummy variable and the level of agricultural wealth after the introduction of sibling fixed effects to the model. These effects control for family differences. In households where there is a single male sibling, the single male represents the entire sibling effect. In terms of interpretation of this significant negative coefficient, it should be regarded as an additional birth order effect.

The preliminary analysis and Tables 3-13 and 3-14 in Appendix G showed that the first two male offspring inherited names from their grandparents. Of the sons that inherited a name from their father, only those born third dominated the practice. The coefficient on a dummy variable for paternal name inheritance would therefore be negative if the eldest sons named after grandfathers inherited the largest portion of their fathers' agricultural estate. A 'loyalty' or kinship effect toward settlers that inherited names from their fathers was absent. Consequently,

the dummy variable did not play a significant positive role in determining a son's likelihood of inheriting agricultural wealth and consequently persisting in their district of origin.

This is a finding in line with recent literature suggesting only a small or insignificant relationship between siblingship induced personality effects and socioeconomic outcomes. More likely is that, regardless of birth order, settlers adapted to the volatile conditions in the pre-industrial, historically underdeveloped society of Stellenbosch. Those that were fortunate enough to have acquired substantial amounts of agricultural wealth were able to persist in the district for longer. These recipients of agricultural inheritance were concentrated among earlier born siblings. Agricultural wealth was the major vehicle through which a settler's birth order position determined their migratory decisions, given the inverse relationship between agricultural wealth and birth order.

Table 3-7 Linear regression models for wealth determinants of settlers that exited and persisted in the Stellenbosch district

	Dependent Variable: ln(Slaveholdings)					
	(1)	(2)	(3)	(4)	(5)	(6)
ln(Brother Birth Order)	-0.11***	-0.07***	-0.08***			
	-0.03	-0.03	-0.03			
DUM(Name Inheritance Father)				0.03	0.04	0.02
				-0.03	-0.02	-0.02
Observations	10291	10291	10291	10291	10291	10291
R2	0.00	0.10	0.09	0.00	0.10	0.09
Adjusted R^2	0.00	0.09	0.08	0.00	0.09	0.08
Left Censored Control	No	Yes	Yes	No	Yes	Yes
Year Controls	No	Yes	Yes	No	Yes	Yes
Age Controls	No	Yes	No	No	Yes	No
Length of Survival Controls	No	No	Yes	No	No	Yes
Sibling Fixed Effects	No	No	No	No	No	No
	(7)	(8)	(9)	(10)	(11)	(12)
ln(Brother Birth Order)	-0.11***	-0.07**	-0.08***	-0.20***	0.01	-0.30***
	-0.03	-0.03	-0.03	-0.03	-0.05	-0.03
DUM(Name Inheritance Father)	-0.01	0.02	0.00	-0.05*	-0.03	-0.05**
	-0.03	-0.03	-0.03	-0.03	-0.02	-0.02
Observations	10291	10291	10291	10291	10291	10291
R2	0.00	0.10	0.09	0.63	0.69	0.68
Adjusted R^2	0.00	0.09	0.08	0.60	0.66	0.66
Left Censored Control	No	Yes	Yes	No	Yes	Yes
Year Controls	No	Yes	Yes	No	Yes	Yes
Age Controls	No	Yes	No	No	Yes	No
Length of Survival Controls	No	No	Yes	No	No	Yes
Sibling Fixed Effects	No	No	No	Yes	Yes	Yes

Note: *p<0.1; **p<0.05; ***p<0.01
Standard errors in parentheses

To conclude, elder sons were better off in terms of agricultural wealth. Greater wealth was the major vehicle through which earlier-born offspring stayed for longer periods in Stellenbosch. The results allows for the dismissal of birth order induced personality or 'loyalty' effects determining persistence. Instead, elder sons inherited handsomely, and this motivated them to persist for longer. Modern propositions of birth order suggest that personality could also have been applicable in determining differential socioeconomic outcomes. However, this chapter can only speculate in the pre-industrial, largely agrarian context, on the influence of personality on wealth accumulation and migration patterns and the lack of personality data. Agricultural wealth, which was inversely related to birth position, was the main driver of persistence in and migration from Stellenbosch.

3.8 Sampling power

This section briefly discusses concerns regarding sampling bias and choice of observations included in the estimation of the survival model presented in Table 3-6. In the SAF not all subjects had death year data. This is problematic when modelling migration, particularly under the assumption that households that indefinitely stopped appearing in the district panel, migrated from the district. It would have been ideal to have a large overarching dataset covering the entire Cape Colony to circumvent potential sampling bias problems and support estimation power. Unfortunately, however, as is often the case with historical data, this chapter does not have such convenience, and missing data on important modelling parameters is prevalent. Effectively, the 'exit' parameter of the models estimated in Table 3-6 is possibly not constructed correctly, since it may have recorded 'exits' from Stellenbosch for household heads that had in fact passed away.

Table 3-6 presents estimates of survival in Stellenbosch with an expanded dataset, which included households that did not have a recorded death year in the SAF. The dissertation constructs the 'exit' parameter for these households assuming an 'exit' as soon as they indefinitely stopped appearing in the sample, regardless of them having no death year. This strategy tripled sample size and nearly quadrupled the number of individual households observed, even though the way in which the 'exit' variable was constructed was not necessarily accurate seeing as it may include household heads that passed away instead of migrated.

Table 3-8 presents results for repeated estimations, excluding households that did not have a recorded year death. The control variables are similar in size to those in Table 3-6 and statistically significant. The major variable of concern – brother birth order – is no longer

Table 3-8 Complementary log-log survival model for migration from the Stellenbosch district between 1775 and 1803 excluding households for which no year of death was present

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*
Variables	*Exit*	*Exit*	*Exit*	*Exit*	*Exit*	*Exit*	*Exit*	*Exit*	*Exit*
Brother Birth Order (Grouped)	0.05			0.06	0.06	0.04	0.04	0.05	0.05
	(0.05)			(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
First name identical to Father		0.05			0.12				
		(0.21)			(0.22)				
First name inherited from Father			0.06	0.13					0.15
			(0.21)	(0.22)					(0.21)
Any name inherited from father								0.03	
								(0.20)	
Brother Birth Count (Grouped)				-0.00	-0.00	-0.00	-0.00	-0.00	-0.01
				(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
ln(Settlers)						-0.31*	-0.31*	-0.30*	-0.30*
						(0.16)	(0.16)	(0.16)	(0.16)
ln(Slaves)						-0.48***	-0.48***	-0.48***	-0.48***
						(0.10)	(0.10)	(0.10)	(0.10)
ln(Wine)						-0.10	-0.10	-0.10	-0.10
						(0.11)	(0.11)	(0.11)	(0.11)
ln(Cattle)						0.29***	0.29***	0.29***	0.29***
						(0.08)	(0.08)	(0.08)	(0.08)
ln(Production Diversity)						-1.27***	-1.27***	-1.27***	-1.27***
						(0.38)	(0.38)	(0.38)	(0.38)
Constant	-1.91***	-1.77***	-1.77***	-1.95***	-1.95***	-1.23***	-1.23***	-1.24***	-1.29***
	(0.25)	(0.21)	(0.21)	(0.32)	(0.32)	(0.34)	(0.34)	(0.36)	(0.36)
Observations	3,097	3,097	3,097	3,097	3,097	3,097	3,097	3,097	3,097
Number of households	435	435	435	435	435	435	435	435	435
Year Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Note:								Standard errors in parentheses	
								*** p<0.01, ** p<0.05, * p<0.1	

statistically significant, although the direction of the relationship and magnitude of the coefficients are virtually identical. The insignificance of the variable measuring birth order, however, is not necessarily because birth order does not explain migration in any sense. More likely, the very limited dataset undermines the statistical power of the estimations significantly. A relationship between birth order and likelihood of migrating, has even more merit if the results of Table 3-6 are considered alongside those in Table 3-7. Agricultural wealth had a statistically significant inverse relationship with birth order. This serves as substantive evidence that brothers born earlier were less likely to migrate. This conclusion, regardless of the problem with sampling, is, therefore, sensible, especially since the historical qualitative evidence argued in favour of wealthier farming households with larger estates, absorbing smaller ailing farmers upon failure (De Kock, 1924). There is, therefore, historical precedence, according to the qualitative accounts, for well-off households to persist and struggling households to move on. This chapter provides evidence of this empirically. The results of later-born offspring being less wealthy, and according to Table 3-6's expanded sample results, more likely to exit, are, therefore, more credible.

This problem is not devoid of benefit though. It potentially paves the way for future research to improve on the estimation strategy employed here. As of the time of writing, the complete dataset containing all districts in the Cape Colony was not yet available. Once such an encompassing dataset is available, it becomes possible to link the *opgaafrollen* of different districts across time, and obtain an accurate representation of inter-district migration of settler households and model its determinants.

3.9 Summary and conclusion

The major objective in this chapter was to rule out siblingship-induced personality differences as a major determinant of migration from the pre-industrial, historically underdeveloped society of late eighteenth century Stellenbosch. Specifically, the chapter was concerned with establishing whether agricultural wealth was a more significant explanatory variable of settler farmers' migratory decisions.

These objectives are founded in subfields of the psychology literature focusing on evolutionary psychology, child development, psychoanalytic perspectives and personology. Literature such as Sulloway (1995) and Sulloway (1996) suggest that each time a new offspring is born into the parental household it alters the household social environment. The Family-Niche model of Sulloway (1996) and Sibling rivalry theory of Adler (1927, 1928), therefore, enjoyed central

focus in this chapter. To summarise, these models posit that birth order has a significant effect on the personality of each subsequent sibling born, both because of different niches siblings seek to occupy in the family unit and competition existing in this family unit for parental resources and care. These theories argue that an evolving social environment and changing distributions of parental income and time influence personalities. Most of the research that examine how differences in sibship characteristics influence psychology exists for modern societies, however. Furthermore, there is disagreement between research that is more dated and modern literature concerning whether such effects exist and whether they have significant implications for socioeconomic outcomes. This chapter examined whether similar effects are present in a pre-industrial, largely agrarian society. It specifically sought to exclude birth order induced personality effects as a determinant for migratory decisions. The premise for this analysis is that firstborns are generally more status-driven, career-oriented and traditionalistic. This chapter consequently analysed whether the same holds true in a society where the majority of the inhabitants were practising agriculture, and conceptualisations of modern property ownership and education were still decades away.

In addition, since this chapter dealt with birth order and the effects this parameter has on a settler households' likelihood to migrate, it also examines naming conventions. The literature suggests that naming practices are associated with birth order. Earlier-born sons are more likely to inherit a name from elder kin than younger siblings. Parents name their offspring after elder kin in the family, because the underlying intention is parents' desire to promote their longevity and to carry the family name and reputation forward. According to Lieberson and Bell (1992), the ideals parents have for their children, status or societal norms guides the practice of naming offspring after elder kin. For example, it was mostly white and professional class fathers in the twentieth century United States that named sons after themselves (Taylor, 1974). It is, therefore, possible that the effects of birth order on sons' upbringing could confound the effects of naming conventions. Here the aim was, therefore, to exclude given names as a possible vehicle through which preferential parental treatment in terms of resources and care could manifest itself, as well.

In pursuing the objective of analysing migration from Stellenbosch, survival analysis was utilised. The chapter employed an aggregated dataset that links the tax records of the Cape Colony (*opgaafrollen*) and the genealogical records in the form of the SAF. The model includes a set of parameters to establish the determinants of a household persisting in or exiting Stellenbosch. The models rely on a settler household's eventual absence from the district tax

record as indication of an 'exit'. Changes in boundaries and recordkeeping could wrongfully lead to assuming migration for a household that was omitted from the panel for artificial reasons. The safest option is, therefore, to conduct analysis on a period characterised by relative stability. This chapter identified the late eighteenth century, specifically 1775 until 1803 as one such period.

Results suggested that older brothers were less likely to migrate from the district of Stellenbosch compared to their younger siblings. While these findings may confirm what the literature suggests regarding offspring that are born first are less extraverted and more averse to taking risks compared to younger siblings, the effects are small and become insignificant in a smaller dataset. Considering the modern literature alongside these results leads this chapter to conclude that birth order induced personality differences among siblings were not significant in explaining migration from Stellenbosch. Instead, elder male siblings were better positioned in terms of agricultural wealth to persist rather than opting to migrate. There are two possible major explanations for this. Firstly, elder siblings inherited wealthier from their parents. Secondly, but also related to the first explanation, having had more time to learn the agricultural trade of their fathers, first-born sons would have been the natural choice to take over the agricultural operations of their fathers. With more time at their disposal to become actively involved with the family agricultural operation, elder siblings was preferred when it came down to inheriting agricultural wealth from their fathers.

Conducting the complementary log-log survival model analysis from 1775 until 1803, sibship played a significant role in determining settlers' persistence in Stellenbosch. Naming conventions did not. This finding is consistent with modern literature suggesting a significant relationship between birth order and migratory decisions. As noted, however, the results are subject to some critique, given the way in which the 'exit' variable was constructed. Results from a limited sample in which deaths are controlled, did not yield a statistically significant relationship between birth order and likelihood to migrate. The vehicle through which these decisions took place was, therefore, not likely due to birth order induced personality differences though, but rather through differential levels of wealth inheritance and preferential parental treatment when offspring entered adulthood. Wealth and economic circumstances was a consistent major determinant of a settler household's decision to migrate. While there was a systematic relationship between migration and birth order, such a relationship was absent for paternal name inheritance.

An estimated model of the determinants of agricultural wealth returned a birth order coefficient that was statistically significant. Older brothers generally had greater levels of agricultural wealth. Although there are concerns with the findings suggesting birth order explaining 'exit' from Stellenbosch, the fact that older brothers were wealthier, serves as corroborating evidence of their likelihood to persist. The qualitative historical accounts and in the survival models confirm that wealthier households would be less likely to 'exit'. Psychology was, therefore, not a major determinant of exiting Stellenbosch. The greater levels of agricultural wealth owned by elder siblings served a driver for persisting in the district.

3.10 Appendix D

Table 3-9 Settler households present in the Stellenbosch district of the Cape by brother birth order and sibship size in 10 year increments

Year 1790										
Brother Birth Order / **Brother Count**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	4.2%									
2	5.6%	3.5%								
3	5.6%	2.1%	2.6%							
4	4.9%	3.5%	5.3%	3.0%						
5	4.2%	5.3%	3.3%	3.3%	3.0%					
6	3.0%	2.6%	2.6%	3.0%	1.9%	2.1%				
7	1.2%	2.3%	1.4%	2.8%	1.9%	1.9%	0.7%			
8	1.9%	1.4%	0.9%	1.6%	0.5%	0.7%	0.2%	0.5%		
9	0.5%	0.0%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.2%	
10	0.5%	0.5%	0.5%	1.2%	0.7%	0.0%	0.5%	0.2%	0.2%	0.5%

Year 1800										
Brother Birth Order / **Brother Count**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	4.1%									
2	4.1%	5.2%								
3	2.9%	2.9%	0.6%							
4	7.0%	5.2%	5.8%	1.7%						
5	3.5%	3.5%	2.9%	4.1%	2.9%					
6	4.1%	1.7%	1.7%	2.3%	0.6%	0.6%				
7	4.1%	2.9%	2.3%	4.7%	1.7%	2.3%	2.3%			
8	2.3%	0.6%	0.6%	1.2%	0.6%	0.0%	0.6%	0.0%		
9	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.0%	0.0%	
10	0.6%	1.2%	0.6%	1.7%	0.6%	0.0%	0.0%	1.2%	0.0%	0.0%

Year 1810										
Brother Birth Order / **Brother Count**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	4.0%									
2	4.2%	3.7%								
3	4.4%	3.5%	3.5%							
4	3.3%	2.8%	4.2%	2.8%						
5	4.7%	3.7%	4.7%	2.6%	2.6%					
6	3.5%	2.8%	3.0%	1.4%	2.8%	1.9%				
7	3.0%	2.6%	1.4%	1.6%	1.4%	2.3%	1.6%			
8	0.9%	1.6%	1.6%	1.9%	0.9%	1.4%	0.7%	0.7%		
9	0.0%	0.2%	0.0%	0.5%	0.5%	0.0%	0.2%	0.0%	0.0%	
10	0.7%	0.5%	1.2%	0.2%	0.7%	0.5%	0.9%	0.0%	0.2%	0.0%

Year 1820										
Brother Birth Order / **Brother Count**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	5.7%									
2	3.0%	3.6%								
3	3.8%	4.2%	3.4%							
4	4.6%	4.4%	3.8%	2.4%						
5	4.8%	4.0%	2.4%	2.2%	3.0%					
6	3.8%	2.6%	2.6%	2.6%	2.2%	1.6%				
7	2.0%	2.4%	1.2%	1.8%	0.8%	2.4%	1.6%			
8	1.2%	1.2%	1.0%	2.2%	0.6%	1.8%	0.6%	0.8%		
9	0.0%	0.6%	0.4%	0.8%	0.2%	0.0%	0.4%	0.4%	0.2%	
10	0.6%	0.8%	0.6%	0.4%	0.4%	0.4%	0.0%	0.2%	0.2%	0.2%

Year 1830										
Brother Birth Order / **Brother Count**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Year 1840										
Brother Birth Order / **Brother Count**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

1	3.3%										**1**	4.8%									
2	5.6%	5.6%									**2**	4.3%	3.6%								
3	2.2%	2.2%	4.4%								**3**	3.8%	4.3%	2.9%							
4	1.1%	2.2%	3.3%	2.2%							**4**	4.6%	3.8%	5.3%	3.6%						
5	10.0%	3.3%	5.6%	4.4%	2.2%						**5**	5.0%	3.8%	2.6%	2.2%	2.2%					
6	4.4%	3.3%	2.2%	0.0%	0.0%	2.2%					**6**	3.4%	2.2%	2.9%	1.7%	1.7%	1.4%				
7	3.3%	2.2%	2.2%	2.2%	1.1%	0.0%	1.1%				**7**	2.9%	1.7%	2.2%	1.0%	1.9%	1.7%	0.7%			
8	0.0%	2.2%	2.2%	1.1%	1.1%	1.1%	0.0%	1.1%			**8**	1.9%	1.2%	1.4%	0.7%	0.5%	0.7%	1.7%	0.7%		
9	0.0%	0.0%	1.1%	0.0%	0.0%	1.1%	0.0%	0.0%	0.0%		**9**	1.0%	0.5%	0.5%	0.5%	0.5%	0.2%	0.2%	0.0%	0.2%	
10	1.1%	1.1%	1.1%	1.1%	1.1%	1.1%	0.0%	0.0%	0.0%	0.0%	**10**	1.2%	0.5%	0.2%	0.0%	0.7%	1.0%	0.2%	1.0%	0.5%	0.2%

3.11 Appendix E

Table 3-10 Cross tabulation of average slaveholdings for various sibling and brother combinations

All Years and Ages										
Brother Count Sibling Count	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	3.4									
2	6.3	5.6								
3	10.1	8.2	8.5							
4	5.3	5.6	7.5	2.2						
5	10.8	10.2	4.9	6.8	2.6					
6	8.8	3.4	6.4	4.0	11.3	2.2				
7	2.7	5.0	7.4	3.6	3.3	7.8	5.5			
8	9.6	3.7	6.0	6.8	4.9	7.5	2.9	0.0		
9	9.3	5.4	6.0	4.3	5.8	5.8	7.7	2.2		
10	0.0	2.2	11.7	8.7	5.1	6.9	6.0	7.8	7.1	5.3

3.12 Appendix F

Table 3-11 Additional wealth determinant regressions modelling settler wealth as a function of name inheritance and brother birth order

	Dependent variable: ln(Cattle)					
	(1)	(2)	(3)	(4)	(5)	(6)
ln(Brother Birth Order)	-0.18***	-0.10***	-0.13***			
	(0.04)	(0.04)	(0.04)			
DUM(Name inherited from father)				-0.06	0.04	0.04
				(0.04)	(0.04)	(0.04)
Observations	10,060	10,060	10,060	10,060	10,060	10,060
R2	0.00	0.14	0.11	0.00	0.14	0.11
Adjusted R2	0.00	0.14	0.11	0.00	0.13	0.10
Year Controls	No	Yes	Yes	No	Yes	Yes
Age Controls	No	Yes	No	No	Yes	No
Length of Survival Controls	No	No	Yes	No	No	Yes
Left Censored Controls	No	Yes	Yes	No	Yes	Yes
Sibling Fixed Effects	No	No	No	No	No	No
	(7)	(8)	(9)	(10)	(11)	(12)
ln(Brother Birth Order)	-0.20***	-0.09**	-0.13***	-0.43***	-0.25***	-0.56***
	(0.04)	(0.04)	(0.04)	(0.05)	(0.10)	(0.05)
DUM(Name inherited from father)	-0.11**	0.02	0.00	-0.12**	-0.12**	-0.11**
	(0.04)	(0.04)	(0.04)	(0.05)	(0.05)	(0.05)
Observations	10,060	10,060	10,060	10,060	10,060	10,060
R2	0.00	0.14	0.11	0.485	0.555	0.546
Adjusted R2	0.00	0.14	0.10	0.442	0.512	0.504
Year Controls	No	Yes	Yes	No	Yes	Yes
Age Controls	No	Yes	No	No	Yes	No
Length of Survival Controls	No	No	Yes	No	No	Yes
Left Censored Controls	No	Yes	Yes	No	Yes	Yes
Sibling Fixed Effects	No	No	No	Yes	Yes	Yes
Note:						*p<0.1; **p<0.05; ***p<0.01
						Standard errors in parentheses

Table 3-12 Wealth regressions with slaveholdings as dependent variable and brother birth order in levels

	Dependent Variable: ln(Slaveholdings)					
	(1)	(2)	(3)	(4)	(5)	(6)
Brother Birth Order	-0.03***	-0.03***	-0.03***			
	-0.01	-0.01	-0.01			
DUM(Name Inheritance Father)				0.03	0.04	0.02
				-0.03	-0.02	-0.02
Observations	10291	10291	10291	10291	10291	10291
R2	0.00	0.10	0.09	0.00	0.10	0.09
Adjusted R^2	0.00	0.09	0.08	0.00	0.09	0.08
Left Censored Control	No	Yes	Yes	No	Yes	Yes
Year Controls	No	Yes	Yes	No	Yes	Yes
Age Controls	No	Yes	No	No	Yes	No
Length of Survival Controls	No	No	Yes	No	No	Yes
Sibling Fixed Effects	No	No	No	No	No	No
	(7)	(8)	(9)	(10)	(11)	(12)
Brother Birth Order	-0.03***	-0.02***	-0.03***	-0.05***	0.01	-0.07***
	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
DUM(Name Inheritance Father)	-0.01	0.01	-0.01	-0.04*	-0.03	-0.05*
	-0.03	-0.03	-0.03	-0.03	-0.02	-0.02
Observations	10291	10291	10291	10291	10291	10291
R2	0.00	0.10	0.09	0.63	0.69	0.68
Adjusted R^2	0.00	0.09	0.08	0.60	0.66	0.66
Left Censored Control	No	Yes	Yes	No	Yes	Yes
Year Controls	No	Yes	Yes	No	Yes	Yes
Age Controls	No	Yes	No	No	Yes	No
Length of Survival Controls	No	No	Yes	No	No	Yes

Sibling Fixed Effects	No	No	No	Yes	Yes	Yes
Note:						*p<0.1; **p<0.05; ***p<0.01 Standard errors in parentheses

3.13Appendix G

Table 3-13 Proportion of settlers in Stellenbosch that inherited a name from their paternal grandfather by year and birth order, 1775-1803

Year	Birth Order	No	Yes	Not Present	Year	Birth Order	No	Yes	Not Present	Year	Birth Order	No	Yes	Not Present	Year	Birth Order	No	Yes	Not Present	Year	Birth Order	No	Yes	Not Present
1775	1	38%	42%	20%	1780	1	36%	43%	21%	1787	1	36%	47%	17%	1792	1	38%	48%	15%	1798	1	30%	56%	14%
	2	61%	16%	23%		2	59%	20%	22%		2	65%	20%	15%		2	67%	21%	13%		2	59%	24%	17%
	3	63%	15%	22%		3	60%	19%	21%		3	69%	15%	16%		3	73%	11%	15%		3	75%	10%	15%
	4	74%	2%	23%		4	78%	2%	20%		4	81%	2%	17%		4	81%	3%	16%		4	81%	7%	12%
	5	65%	0%	35%		5	77%	3%	19%		5	74%	6%	20%		5	85%	3%	13%		5	91%	2%	6%
1776	1	38%	40%	22%	1782	1	37%	42%	21%	1788	1	38%	44%	18%	1793	1	38%	48%	14%	1800	1	27%	48%	25%
	2	60%	17%	23%		2	61%	22%	18%		2	58%	25%	17%		2	64%	25%	11%		2	65%	18%	18%
	3	63%	13%	23%		3	67%	14%	19%		3	68%	15%	18%		3	76%	12%	12%		3	80%	8%	12%
	4	73%	2%	25%		4	80%	2%	18%		4	80%	5%	15%		4	81%	5%	14%		4	78%	7%	15%
	5	72%	0%	28%		5	75%	3%	22%		5	79%	3%	18%		5	88%	2%	9%		5	91%	0%	9%
1777	1	38%	42%	20%	1784	1	36%	43%	21%	1789	1	39%	48%	13%	1794	1	37%	49%	14%	1801	1	28%	57%	15%
	2	60%	17%	23%		2	62%	20%	18%		2	63%	23%	14%		2	64%	26%	10%		2	68%	21%	11%
	3	66%	16%	19%		3	69%	13%	18%		3	72%	12%	16%		3	73%	11%	16%		3	80%	7%	13%
	4	72%	4%	24%		4	78%	3%	19%		4	79%	4%	18%		4	77%	8%	15%		4	84%	7%	9%
	5	71%	0%	29%		5	76%	3%	21%		5	83%	3%	14%		5	89%	2%	9%		5	89%	2%	9%
1778	1	39%	42%	19%	1785	1	35%	44%	20%	1790	1	43%	46%	11%	1795	1	38%	49%	14%	1802	1	29%	55%	16%
	2	56%	22%	22%		2	61%	21%	18%		2	65%	23%	12%		2	60%	26%	14%		2	67%	19%	13%
	3	71%	15%	15%		3	71%	12%	17%		3	72%	10%	18%		3	72%	11%	18%		3	78%	6%	16%
	4	74%	2%	23%		4	77%	4%	19%		4	85%	2%	14%		4	77%	8%	16%		4	81%	8%	11%
	5	75%	4%	21%		5	78%	3%	19%		5	82%	3%	15%		5	91%	2%	6%		5	87%	3%	10%
1779	1	36%	42%	22%	1786	1	37%	43%	20%	1791	1	37%	50%	13%	1796	1	39%	51%	10%	1803	1	31%	49%	20%
	2	56%	20%	25%		2	61%	21%	18%		2	64%	23%	13%		2	64%	24%	12%		2	63%	22%	15%
	3	65%	18%	18%		3	69%	14%	17%		3	75%	8%	17%		3	71%	13%	17%		3	76%	9%	15%
	4	77%	2%	21%		4	79%	2%	20%		4	83%	5%	13%		4	82%	5%	13%		4	82%	8%	10%
	5	77%	3%	20%		5	76%	6%	18%		5	83%	3%	14%		5	92%	0%	8%		5	88%	4%	8%

Table 3-14 Proportion of settlers in Stellenbosch that inherited a name from their maternal grandfather by year and birth order, 1775-1803

Year	Birth Order	No	Yes	Not Present	Year	Birth Order	No	Yes	Not Present	Year	Birth Order	No	Yes	Not Present	Year	Birth Order	No	Yes	Not Present	Year	Birth Order	No	Yes	Not Present
1775	1	61%	19%	20%	1780	1	62%	19%	19%	1787	1	63%	22%	15%	1792	1	60%	28%	12%	1798	1	62%	28%	10%
	2	56%	22%	22%		2	56%	21%	24%		2	66%	21%	13%		2	60%	24%	17%		2	61%	29%	10%
	3	72%	9%	20%		3	69%	11%	19%		3	66%	19%	15%		3	58%	25%	16%		3	67%	21%	13%
	4	70%	7%	23%		4	71%	4%	25%		4	70%	11%	19%		4	75%	10%	16%		4	70%	11%	19%
	5	81%	4%	15%		5	71%	10%	19%		5	71%	6%	23%		5	69%	10%	21%		5	77%	9%	15%
1776	1	60%	18%	22%	1782	1	62%	21%	17%	1788	1	61%	24%	14%	1793	1	59%	28%	12%	1800	1	61%	29%	11%
	2	54%	24%	22%		2	57%	21%	23%		2	64%	19%	17%		2	62%	22%	16%		2	53%	35%	13%
	3	69%	10%	21%		3	70%	12%	18%		3	63%	21%	16%		3	58%	24%	18%		3	60%	24%	16%
	4	65%	8%	27%		4	69%	6%	24%		4	74%	11%	15%		4	77%	8%	16%		4	78%	7%	15%
	5	81%	6%	13%		5	67%	6%	28%		5	74%	5%	21%		5	72%	7%	21%		5	73%	9%	18%
1777	1	62%	18%	20%	1784	1	59%	24%	17%	1789	1	63%	26%	12%	1794	1	58%	31%	11%	1801	1	57%	27%	16%
	2	54%	22%	23%		2	58%	22%	19%		2	67%	18%	15%		2	63%	21%	16%		2	53%	36%	10%
	3	69%	9%	22%		3	65%	14%	21%		3	59%	25%	16%		3	64%	23%	12%		3	64%	24%	12%
	4	67%	9%	24%		4	74%	7%	19%		4	75%	7%	18%		4	77%	6%	17%		4	75%	13%	12%
	5	79%	7%	14%		5	68%	3%	29%		5	64%	11%	25%		5	71%	7%	22%		5	78%	9%	13%
1778	1	62%	17%	20%	1785	1	59%	23%	18%	1790	1	61%	28%	11%	1795	1	58%	33%	9%	1802	1	58%	26%	16%
	2	56%	23%	21%		2	59%	25%	16%		2	66%	18%	16%		2	63%	23%	13%		2	55%	36%	10%
	3	71%	7%	22%		3	63%	17%	20%		3	59%	23%	18%		3	64%	23%	14%		3	67%	23%	10%
	4	60%	6%	34%		4	74%	7%	19%		4	73%	11%	17%		4	78%	6%	16%		4	69%	16%	15%
	5	75%	11%	14%		5	65%	3%	32%		5	62%	12%	26%		5	72%	9%	19%		5	80%	8%	11%
1779	1	64%	17%	19%	1786	1	62%	22%	16%	1791	1	63%	26%	10%	1796	1	59%	32%	10%	1803	1	58%	26%	16%
	2	54%	21%	26%		2	63%	21%	16%		2	60%	23%	17%		2	64%	25%	11%		2	54%	34%	11%
	3	68%	7%	25%		3	63%	19%	18%		3	56%	24%	20%		3	61%	25%	14%		3	68%	24%	8%
	4	69%	6%	25%		4	72%	8%	20%		4	75%	10%	16%		4	75%	7%	18%		4	69%	17%	14%
	5	77%	10%	13%		5	68%	6%	26%		5	64%	11%	25%		5	71%	8%	21%		5	76%	14%	10%

Chapter 4

4 Two solutions to lifecycle bias in intergenerational mobility estimation

4.1 Introduction

Solon (1992) argues that intergenerational socioeconomic status (SES) transmittance (mobility) violates the equality of opportunity principle. For example, low SES households do not invest sufficiently in human capital when inequality is high (Kearney and Levine, 2016). This diminishes opportunities for social mobility. Research suggesting an association between rising levels of inequality and dwindling (or stable) SES advancement (mobility) has recently started to emerge (Corak, 2013). Hassler, Mora and Zeira (2007) developed a model explicitly modelling the relationship between inequality and mobility. This relationship emphasises the importance of studying intergenerational wealth transmittance and producing unbiased mobility estimates. Given the significance of studying wealth dynamics and mobility and with the emergence of more advance empirical techniques, there has been an increase in the volume of research concerning estimation issues concerning wealth dynamics and intergenerational SES transmittance (Haider and Solon, 2006; Nybom and Stuhler, 2016; Nybom and Stuhler, 2017). Understanding mobility would afford policymakers the opportunity to identify the risk factors for persistence and inequality. The biases, to which intergenerational mobility estimates may be subject to, are founded in temporal economic environment changes and individual lifecycle effects.

The crux of this chapter, therefore, is not to examine the interaction between mobility and inequality in the Cape Colony per se. Instead, it is concerned with the problem of estimating mobility without bias. Such estimation firstly comprises accounting for differences in lifecycle patterns. Secondly, it controls for time-varying macroeconomic contexts. These time-variant macroeconomic contexts are interlaced with lifecycle patterns (Grawe, 2006). The reason for this chapter's central concern being methodological in nature instead of being mainly empirical is the issue of lifecycle effects and temporal economic changes presenting as lifecycle effects that would lead to biased mobility estimates. In estimating the extent of these biases and controlling for the lifecycle effects, it produces an unbiased estimate of intergenerational mobility in the Cape Colony.

The lifecycle bias literature serves as point of departure. An individual's social status, income, wealth or education naturally vary over the course of their lifecycle. Haider and Solon (2006) confirm this variance by regressing current earnings annually to show considerable systematic differences over the course of the lifecycle. Failing to account for these differences would result in lifecycle biases (Haider and Solon, 2006; Favre, 2019). The SES of an individual at a particular point in their life is not representative of their lifetime economic status. The relationship between short-term wealth and lifetime wealth varies over the lifecycle. Lifecycle differences result in biased estimation of intergenerational mobility (Jenkins, 1987; Grawe, 2006; Nybom and Stuhler, 2016).[63] Easterlin, Schaeffer and Macunovich (1993) argue that when estimating within-age intergenerational mobility, it is essential to measure the income of individuals and their parents (or any income or wealth proxy for that matter) at the same stage of their respective lifecycles to remove differences in lifecycle patterns. In estimating wealth intergenerational mobility, Haider and Solon (2006) illustrate the significant underestimation of persistence, if sons' wealth or income are measured earlier in their lifecycle, as opposed to measuring it in their middle-age. Moreover, using a point-proxy measure to approximate lifetime status would lead to biased estimation of intergenerational status transmittance (Nybom and Stuhler, 2017).

Not only would lifecycle effects result in biased intergenerational mobility estimates, but varying macroeconomic contexts could also be potentially problematic. Conventional research only has snapshots of wealth of fathers and sons in the form of census data (Ferrie, 2005; Bailey and Dynarski, 2011; Erikson, Goldthorpe, and Hällsten, 2012; Long and Ferrie, 2013). These studies are unable to control for period biases that may present themselves as lifecycle effects (Jenkins, 1987; Grawe, 2006). The long-run longitudinal dataset used in this chapter circumvents this problem. In addition, it allows for using a significant date of 1807 in the current pre-industrial, slave-economy context to serve as a reference point for analysing changes in macroeconomic conditions. The governing authority outlawed slave imports aboard British ships in the year 1807. This prohibition had significant effects on wealth accumulation in an economy that was dependent on slave labour.

[63] As an alternative explanation of these lifecycle differences, research of Ando and Modigliani (1963), Modigliani (1966) and Modigliani (1986) could serve as a point of reference. Wealth accumulation, savings and consumption differ across the individual lifecycle as needs and desires evolve and earnings and wealth increase up to a certain age.

This chapter analyses intergenerational mobility in the Stellenbosch district of the Cape Colony – a pre-industrial, historically underdeveloped society. The focus is on this district given the availability of a sufficiently long longitudinal dataset of seventy years. The dataset length allows for linking parental and offspring wealth.

Stellenbosch was mainly concerned with viticulture and relied on slave labour.[64] The abolition of slave imports in 1807 is ideal to illustrate the potential methodological issues in estimating intergenerational mobility in varying macroeconomic contexts. Not only were economic circumstances different after the abolition, but lifecycle accumulation of wealth changed substantially as sons inherited less capital to start farming operations (Martins, 2019). This chapter, therefore, limits the analysis to a group of sons found in the dataset after 1807. Fathers' wealth holdings are measured before 1807 and, therefore, did not experience the same shock. The varying contexts also influenced lifecycles, raising the risk of severe lifecycle bias in estimating intergenerational mobility.

This chapter employs two approaches in estimating mobility to control for lifecycle and period effects. The first approach involves measuring the wealth of two generations at the same stage in their lifecycles. This measurement consequently takes place in two different periods with different macroeconomic contexts. These varying contexts in which fathers' and sons' levels of wealth are measured, would lead to biased mobility estimates. The biases result from lifecycle effects captured in the intergenerational mobility estimates. The second approach entails measuring the two generations' wealth in the same period. This exposes mobility estimation to lifecycle biases given that the two generations are measured at different stages in their lifecycles – even though period biases are dealt with. This chapter accounts for these differences by introducing appropriate birth year controls to the intergenerational mobility models. The result is a less biased estimate of intergenerational wealth mobility.

The structure of this chapter is as follows: Section 2 investigates the intergenerational mobility literature. Section 3 provides a brief historical overview. This chapter explains the methodology applied in this research in Section 4. Section 5 discusses the results and Section 6 concludes.

[64] Slaveholdings were viewed as an important vehicle for the development of the young Cape economy by the authorities (Du Plessis, Jansen and von Fintel, 2015) and it was a capital investment within our historical context (Guelke and Shell, 1983; Fourie, 2011; Martins, 2019). This chapter, therefore, views slaveholdings as a historical asset in the slave-based Stellenbosch economy.

4.2 Literature review

4.2.1 Brief conceptualisation of intergenerational mobility

Mobility functions as a robust indicator of the level of opportunity for SES advancement in a particular society. In other words, mobility indicates how equitable a society is in dispensing equal and fair opportunities (Solon, 1992).[65] A lack of mobility is of particular concern if wealth is concentrated among the wealthiest percentiles of society and persists among this group (Björklund, Roine and Waldenström, 2012). Bourdieu, Ferrie and Kesztenbaum (2009) conduct a comparative study of the historical intergenerational mobility in France and the United States; they regard mobility as an indicator of the degree of vitality of a society and the capacity of the society to develop and improve. A society in which there is little mobility is primarily characterised by SES that is fixed. This means that status is predetermined at birth, with unyielding schemes determining fathers' wealth transference to their sons. Becker and Tomes (1986) developed a model illustrating this. This model served as theoretical framework for both earlier and recent mobility research (Solon, 1992; Dearden, Machin and Reed, 1997; Galor and Tsiddon, 1997; Chadwick and Solon, 2002; Corak, 2013; Jäntti and Jenkins, 2013). Similarly, this chapter follows the example set by these studies and bases its estimations on the Becker and Tomes (1986) framework due to its ease of implementation with the data at hand and theoretical robustness.[66]

Parents investing in the human capital of their offspring, partly determine next generation's SES (Corak, 2006; Dribe and Helgertz, 2016). This chapter, therefore, expects a positive correlation between parental SES and that of their offspring. Solon (1992) and Zimmerman (1992) confirm this positive relationship, using income and lifetime earnings in the United States, albeit smaller than initially expected after controlling for measurement error.

[65] Social mobility, in essence, is an indicator of the level of equality of economic opportunity in a society (Long, 2013). The size of the impact of inequality on a society is a function of the degree of social mobility that could potentially alleviate some of the societal pressures and similar problems that inequality in wealth, income or lifestyle spawns. If familial background were not as significant in determining future success, then the overall impact of inequality on social cohesion and societal stability would have been pervasive.

[66] In theoretical terms, this framework posits that in a society characterised by inequality, the father's SES determines the SES of the son.

4.2.2 Lifecycles and mobility across generations

Estimating mobility is futile if lifecycle and period biases are not controlled. This chapter has access to a seventy-year-long dataset for the Stellenbosch district of the Cape Colony. It is, therefore, possible to establish links between the agricultural wealth of fathers and sons.

Wealth of an individual at one particular point in time might not represent their lifetime wealth (Favre, 2019). Having access to data for an individual at particular points in their life, instead of an overall measure of lifetime wealth, would subject estimations to lifecycle biases (Jenkins, 1987; Böhlmark and Lindquist, 2006). This becomes a particularly significant issue when the correlation between current wealth and long-term wealth of an individual varies systematically over their lifecycle. Haider and Solon (2006) note that having measurement error in sons' wealth indicator undermines consistency in intergenerational mobility estimation. Measurement errors in fathers' wealth metric, on the other hand, would compound the aforementioned problem or result in attenuation consistency. Jenkins (1987) and Nybom and Stuhler (2016) note the problem of having only snapshots of earnings for individuals in mobility estimation, as opposed to their lifetime earnings. This research strategy has previously been followed by Ferrie (2005), Bailey and Dynarski (2011), Erikson, Goldthorpe, and Hällsten (2012) and Long and Ferrie (2013). These snapshots would result in biased intergenerational mobility estimates. The dataset and methodology proposed and executed in this chapter circumvents this problem.

Grawe (2006) finds that fathers' age, exerts significant negative effects on intergenerational mobility estimates. There are two potential causes for these effects (Jenkins, 1987). Firstly, error-in-variables bias increasing across time produces period effects that present as lifecycle effects. Secondly, the permanent component of earnings increases over the individual lifecycle, which would result in a lifecycle bias. It is crucial to control for heterogeneity in income profiles that differs across individual lifecycles (Easterlin, Schaeffer and Macunovich, 1993; Nyborm and Stuhler, 2016). The most appropriate age at which to estimate mobility is difficult to establish. Using an annual measure to proxy lifetime status when estimating persistence in SES is, therefore, still susceptible to lifecycle bias. For Swedish tax data, Böhlmark and Lindquist (2006) employ Haider and Solon's (2006) errors-in-variables model to illustrate the presence of significant lifecycle patterns in income. These lifecycle patterns would result in lifecycle-biased estimates when employing proxy indicators for lifetime status indicators if not adequately controlled.

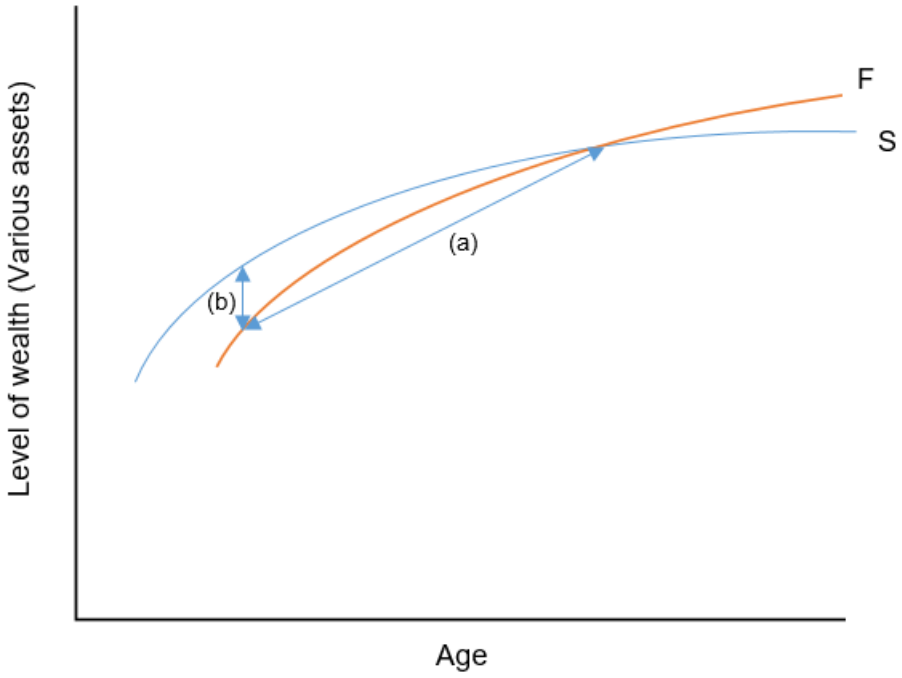

Figure 4-1 Illustration of lifecycle and period biases in intergenerational mobility estimation

Source: Adapted from Haider and Solon (2006) and Nybom and Stuhler (2016)

Figure 4-1 is a graphical representation of the problem caused by lifecycle and period biases when analysing intergenerational data in the long run and presents the level of wealth as a function of the lifecycle. Keeping the change in slave import legislation in 1807 in mind, the orange graph F is the level of fathers' wealth before the change. The blue graph S is the level of sons' wealth as measured after 1807. Consistent with Haider and Solon (2006) and Nybom and Stuhler (2016), Figure 4-1 illustrates heterogeneous wealth profiles across age – line (a) in Figure 4-1. Line (a), therefore, represents the wealth of two subsequent generations measured at different ages at the same time. Estimating the mobility represented by line (a) is the within-cross section approach. It is consequently required to account for the vertical distance of line (a) by including lifecycle controls. Additionally, in accordance with Jenkins (1987) and Grawe (2006), period biases are illustrated with the difference between the level of fathers' and sons' wealth measured at the same age – line (b) in Figure 4-1. The different macroeconomic contexts in which measurement takes place biases wealth measurement at the same age for two different generations. Since the sizes of lines (a) and (b) differ, reneging on controlling for period and lifecycle biases yields different mobility estimates depending on the estimation approach employed. The difference in the lengths of lines (a) and (b) illustrates the source of the biased estimates.

The change in slave import legislation would have had an inevitable effect on intergenerational mobility estimation as well. This research is similar to Easterlin, Schaeffer and Macunovich (1993) who examines if Baby Boomers in the United States were worse off than their parents were in terms of status. In this chapter's context, sons who were at the earliest stage in their lifecycle post-1807, were exposed to arguably more challenging conditions – at least as far as acquiring slaveholdings was concerned – in which to operate their slaveholding based agricultural ventures.

Secondly, as a summary, Table 4-1 illustrates that the analysis is possible through the long-run historical dataset of individual level agricultural wealth and output, which this chapter discusses in detail in the methodology section. The approach requires linking father's wealth to son's wealth and consequently modelling the correlation between the two. However, for some father-son pairs there is only a single link – for others there are multiple links across time. To have one point from which to estimate wealth persistence would result in biased estimates.

Table 4-1 Summary and comparison of the two estimation strategies followed in this research

Estimation Strategy (a): Within-Cross Estimation	Estimation Strategy (b): Within-Age Esimation

• Made possible with our long-run panel dataset
• Observe fathers and sons at the same point in time
  • Fathers and sons observed at different stages in their respective lifecycles
  • Same macroeconomic context
• Circumvents the impact of period bias
• Different stages in their life cycles necessitate inclusion of age controls
  • Controls for life cycle bias
  • Fathers are observed later in their adult lives when life time levels of wealth are reached while sons' wealth is still stabilising
	• Made possible with our long-run panel dataset
	• Observe fathers and sons at the same age
	  • Fathers are observed in their youth prior to the 1807 slave legislation change
	  • Sons are observed post-1807
	• Circumvents the impact of life cycle bias
	• Different regimes or macroeconomic contexts necessitates inclusion of temporal controls
	  • Controls for period bias
	  • Macroeconomic regime differences would have had an especially significant impact on sons' wealth accumulation earlier in their adult lives

Estimation Strategy (a) observes fathers' and sons' wealth at the same point in time – post-1807. This allows estimation in the same macroeconomic context. For current purposes, this control is useful to take account of the abolishment of the trans-Atlantic slave trade in 1807. Given this intra-period analysis, the methodology applied here compares fathers and sons wealth at different stages in their respective lifecycles, albeit in a similar macroeconomic context. Measuring wealth for fathers and sons in the same period circumvents the problem of

different macroeconomic circumstances influencing the lifecycle wealth accumulation of the two generations.

Measuring wealth in the same period, however, naturally results in measuring the wealth of fathers and sons at different points in their lifecycles. Only having access to snapshots of economic status, results in the biased mobility estimates (Jenkins, 1987; Böhlmark and Lindquist, 2006). The status of an individual measured at the start of their life, is not representative of their lifetime status (Lillard, 1977; Haider and Solon, 2006). Fathers are nearing the end of their adult lives and are, therefore, near or at their lifetime level of wealth. Sons, on the other hand, are at the start of their adult lives. They still have some time to go toward reaching their lifetime level of wealth. For this reason, it becomes necessary to include controls for lifecycle bias. Long (2013) finds that after controlling for lifecycle effects in comparing the mobility from snapshot estimations of Britain from the 1850s to 1970s, result in downward bias of mobility. Similarly, Erikson and Goldthorpe (1993) argue that in the long run there is not much change in the level of mobility.

Controlling for lifecycle biases is a significant aspect in the intergenerational mobility literature. The existence of heterogeneous age-earnings profiles necessitates controlling for lifecycle bias, with younger individuals earning significantly less or having acquired substantially less wealth spanning their short careers, compared to older individuals (Lillard, 1977; Haider and Solon, 2006). After controlling for lifecycle biases and transitory shocks in intergenerational mobility estimation for the modern US and Germany, Chau (2012) finds greater levels of wealth persistence.

Estimation Strategy (b) involves mobility estimation with fathers' and sons' wealth measured at the same point in their lifecycles. This strategy involves observing fathers at young ages pre-1807, before amendments to the slave legislation, while observing sons post-1807. Whereas this estimation strategy allows controlling for lifecycle biases, estimation takes place in vastly different macroeconomic contexts. In researching mobility in the 1970s in the United States, Hout (1984) and Hout (1988) suggest that changes in the occupational opportunity structure of the United States influenced intergenerational mobility estimates. In the pre-industrial, largely agrarian context analysed in this research, the vehicle of period bias may be different, but the implications are the same.[67] The different contexts would have had a significant impact on

[67] As noted in Fourie and von Fintel (2014), the so-called 'secrets' of the trade may instead be the vehicle that transfers the wealth. Aside from the material wealth sons stood to inherit, fathers would have relayed to them the expertise or know-how required to be a successful wine or crop farmer in the context of the Stellenbosch district of the Cape Colony.

wealth accumulation, especially among sons. In the slave-driven Cape economy, abolishing slave imports hold implications for the sons' ability to accumulate wealth relative to their fathers. For example, offspring would not have been able to import slaves like their fathers after 1807. Period bias, therefore, requires the inclusion of temporal controls to eliminate its effects on intergenerational mobility estimates. Biblarz, Bengston and Bucure (1996) raise the question of whether exogenous shocks or circumstances lead to systematic declines in the extent to which parental SES affects the status of sons. While this chapter does not explicitly examine the presence of such declines, it explores the impact that period bias exerts on intergenerational mobility estimates.

The greater difficulty of acquiring slaveholdings as major labour source may have an equalising effect on society as a whole. It was mainly the wealthier households that had enough capital to afford slaves. Poorer households, on the other hand, were unable to experience the economies of scale inherent to slave labour. It therefore could have resulted in greater levels of mobility, once controlling for period bias. DiPrete and Grusky (1990), Grusky and DiPrete (1990) and Hout (1984, 1988) report that the changing macroeconomic circumstances of the modern US labour market made achievement more important than ascription in determining offspring status. Therefore, controlling for the change in the macroeconomic structure of the US, gave way to greater estimated levels of mobility.

Age controls are also included, given that the sample necessarily measures father-son pairs at different ages relative to other father-son pairs. Since Grawe (2006) reports a negative relationship between mobility and the age at which fathers' and sons' wealth holdings are measured,[68] it becomes clear why it is necessary to include age controls as well. Estimating mobility of the father-son pair at a later stage in their lifecycle would result in an underestimation of mobility (or overestimation of persistence). Both the father and son are at advanced stages in their lifecycles and approaching their lifetime level of wealth. To control for this lifecycle effect, it is necessary to include age effects in mobility estimations.

4.3 Historical background

This section provides an outline of the economic conditions in the Cape during the late eighteenth and early nineteenth centuries. This lays the groundwork for understanding the level of wealth mobility for various generations at the Cape and the factors that could impede or

[68] Haider and Solon (2006) also confirm this so-called right-side measurement errors in causing errors-in-variable attenuation bias.

support wealth transmittance. These factors include how liberal Cape markets were (in terms of price determination of produce), the prevailing inheritance laws which would determine how easy it was for sons to inherit wealth from their fathers, and how population expansion may have inhibited mobility with quality and fertile land becoming short in supply.[69] The major focus, however, is on the 1807 slave legislation amendments and the implied temporal and lifecycle biases when estimating intergenerational mobility.

4.3.1 Overview of the Economy and Population Growth

After their arrival in 1652, the VOC released several employees as *free burghers* into the immediate vicinity of the fort to pursue agricultural activities.[70] As the Cape grew in importance as port of call for ships trading with societies in the Indian Ocean and Asia, the period 1670 until 1700 witnessed a substantial growth in the Cape's population. Hundreds of immigrants from France, the Netherlands and Germany, who were adept in arable farming, arrived at the Cape. These immigrants settled in regions spread across the present day Cape Winelands, and they quickly became productive in yielding maize, wine and brandy.

Due to the trade restrictions and a lack of a deep enough market to absorb all of the arriving immigrant European farmers' agricultural yields, the economy of the Cape Colony started to stagnate (De Kock, 1924:27). Recent research, disputing this view of a struggling economy, suggests that farmers in the Cape Colony were able to maintain relatively high living standards (Du Plessis and Du Plessis, 2012; Fourie, 2013). There was also no significant oversupply of agricultural production outputs. Du Plessis and Du Plessis (2012) provide evidence for slow but steady market expansion at the Cape during the eighteenth century. Living standards of settlers at the Cape were even comparable to those of the people living in their European countries of origin and there is no evidence suggesting a decline in these standards over the course of the 1700s (Fourie, 2013). During the early eighteenth century, farming households of all sizes experienced returns reflective of an economic boom (Guelke and Shell, 1983). The implication of this empirical evidence is, therefore, that there were considerable levels of

[69] With the Cape of Good Hope being a largely agrarian society, particularly in the earlier years of its existence, land prices and fertility would intuitively be highly significant in explaining how mobile a particular generation was. Those settler families that were the first to settle on a relatively fertile piece of land, would not easily have given up their comparative advantages as quality land became in short supply in the midst of a booming settler, farming population. Effectively, sons inheriting from these families, would have been relatively better off than those whose fathers who were unable to enjoy 'first-arriver' advantages.

[70] *Free burghers* were settler farmers that were once in the employment of the Dutch-East India Company (VOC), but were released to pursue agricultural activities by the Company, in order to support output and minimise operational costs.

wealth at the Cape. Establishing the magnitude of wealth transmittance across generations is crucial to understanding Cape Colony development and wealth distribution. Lifecycle and period effects, however, jeopardise efforts at unbiased estimation.

While the domestic market for goods produced at the Cape might have been limited, the high levels of European ship traffic at the Cape exerted significant effects on the medium-term business cycle (Boshoff and Fourie, 2010). Fourie and Van Zanden (2013) confirm docking ships en route to elsewhere as a market for Cape produce. Moreover, the arrival of French Huguenots supported the production of the Cape wine production. Du Plessis, Jansen and von Fintel (2014) note that larger farmers during the early eighteenth century were more likely to enjoy high returns on their slaveholdings, compared to smaller farmers.

It is, therefore, possible that settlers, who were not able to deal with the difficult market and geographic conditions at the Cape, either returned to the service of the VOC or returned to their country of origin (De Kock, 1924). Only those households that had the knowledge, perseverance and adaptability were able to persist. This knowledge of the surviving farmers in the Cape Colony's harsh geographic environment and challenging market conditions would have been transmitted to their offspring. After the turn of the eighteenth century, these offspring occupied all new farms on arable land of relatively high quality. With no systematic and continual process of immigration yet existing at this time (apart from the boom between 1670 and 1700), the major driver of growth in the Cape Colony's population in the early eighteenth century was births. Settlers born in the Cape were consequently endowed with an advantage over later arriving immigrants, as they were not only likely to inherit the accumulated agricultural wealth from their early arriving fathers, but also have more knowledge about the proper farming methods and the thrift necessary to prosper as a farmer. The latter, understandably, was passed down through generations.

4.3.2 Slave import ban of 1807

Slaveholdings played a significant role in the Cape Colony's economy, both as capital investment and as productive asset (Guelke and Shell, 1983; Fourie, 2011; Martins, 2019). Any legislation that influences the ease of acquiring slave labour would have far-reaching consequences for the lifecycles of settlers at the Cape. Such effects would have been pervasive among settlers in industries where the economies of scope and scale inherent to slaveholdings were significant. In the viticulture-focused economy of Stellenbosch, the use of imported slave labour was prevalent, given the dearth of capital and labour to establish extensive arable

farming and viticulture operations (Guelke, 1982). Slavery enabled extensive, large-scale farming.

Because the Cape was characterised by large areas of unoccupied land, the Colony faced a labour shortage. If settlers could simply manage their own farming operations they could not be coerced into working for wages (De Kock, 1924:36). The VOC realised this, and in an effort to suppress costs and inflate margins, they resorted to importing slave labour. The preference for slave labour in arable farming and viticulture is due to crop and wine farming that was labour intensive. Farmers could benefit from economies of scope and scale by employing more labour inputs in their operations (Fourie and von Fintel, 2011; Fourie, 2011). In order to justify the initial costly capital investment in slaveholdings, it was necessary for farmers to conduct extensive agriculture on a large scale. Therefore, it was beneficial for farmers to have greater, rather than smaller slaveholdings and agricultural operations. The steady increase in slaveholdings over the course of the eighteenth century, suggests that settlers were able to accumulate considerable levels of wealth during this period (Fourie and von Fintel, 2011).

The large tracts of land, extensive farming operations pursued, and primitive farming methods employed at the Cape exacerbated the need for slave labour.[71] The lack of labour-saving tools, implements and farming methods for efficient cultivation necessitated the use of hand-labour in the form of slaveholdings. Later, wealthy settlers invested their surplus wealth in slaveholdings, instead of labour-saving capital goods and innovative tools and implements (Fourie, 2013). This further entrenched settler farmers' reliance on cheap labour, and although it had short-term benefits, it resulted in a long-term wealth plateau (Fourie, 2011).

The Cape's slave-economy was characterised by substantial inequality (Fourie and von Fintel, 2010a; Fourie and von Fintel, 2011). The VOC aimed to keep profit margins inflated and input costs at the Cape as low as possible. To accomplish this, the VOC deemed it necessary to import slave labour instead of encouraging European immigration (Fourie, 2011). For most of the eighteenth century, slaves consistently outnumbered the number of settlers at the Cape (Worden, 1985:11).

[71] Guelke (1982) notes that farmers were forced to practise extensive farming at the Cape initially, given the unwillingness of the VOC to invest reasonable amounts of money in the Colony (in their objective of keeping margins as high as possible). There was not enough capital at the Cape to adopt the type of intensive farming approaches as in Europe.

The Slave Trade Act, ratified by the British Empire on 24 March 1807, had significant ramifications for the slave-driven economy of the Cape and for Stellenbosch in particular. The act entailed ending the transport of all slaves on British ships of import. The British Empire was generally strict in enforcing this legislation, and there were considerable consequences for those who contravened the act, including hefty fines (Martins, 2019).

Currently the specific country-level effects of the abolishment of the slave trade is not yet fully understood (Martins, 2019). What is clear, however, is that it resulted in a systematic increase in slave prices, and eventually a systematic decline in slaveholdings in the Colony.

Domestic slave populations were incapable of producing surpluses, and a lower supply naturally resulted in more capital being required to obtain slaves (Fourie and Green, 2018b; Martins, 2019). The Act did not prevent the farmers from acquiring slaves. If anything, the Act only caused slower rates of slave acquisition. This consequently led to a change in the lifecycle accumulation of agricultural wealth. After 1807 it was not possible for sons, to acquire wealth at the same rate as their fathers in that period, nor at the same age as their fathers under the previous slave regime. While there was a decline in the production of other crops in the Stellenbosch district, wine production witnessed a steady increase post-1807. This was due to a redirection of all excess slave labour toward viticulture and away from crop farming.

In the context of this chapter, increased slave prices after the implementation of the Slave Trade Act implied that youthful settler sons residing in Stellenbosch after 1807 faced greater barriers to enter into the viticulture and arable farming industries. Additionally, they would also have found it more challenging with the lower margins due to higher input costs, to sustain profitable farming operations relative to the pre-1807 generation. This justifies using 1807 as a significant year beyond which to measure the impacts of lifecycle and period biases on intergenerational mobility.

4.4 Data and methodology

4.4.1 Data

This chapter relies on the official tax censuses (*opgaafrollen*) of the Cape Colony and genealogical records contained in the SAF. Fourie and Green (2018a) explain the background of the *opgaafrollen*.

The governing authority at the Cape calculated tax due to a settler household on asset ownership and agricultural output. Therefore, apart from data on household size and spouse

names, the *opgaafrollen* contain data on livestock owned, crops, vines, and wine and brandy in supply. The total panel dataset spans 65 years – from 1770 until 1844, which allows for a reasonably sized sample, containing several wealth measures of fathers and sons linked in age and time. The unbalanced panel dataset consisted of 750 father-son linkages. The annual *opgaafrollen* was constructed using a similar linkage method as Rijpma, Cilliers and Fourie (2019).

The second data source this chapter employs is the South Africa Families (SAF) register. This dataset is a demographic record of all individuals that resided in the Cape until the late nineteenth century. Cilliers (2016), who provides a complete description of the data, initially used this dataset in studying the demographics of Cape Colony. Birth dates and family identifiers are the two variables the current analysis is concerned with and allows calculation of ages and linking fathers to their offspring. The SAF was linked to the *opgaafrollen* using a string distance linking algorithm similar to that used for linking the *opgaafrollen* across time.

4.4.2 Model

The theoretical model developed by Becker and Tomes (1986) serves as framework for this chapter's methodology. The model expresses the sons' level of wealth as a linear function of their fathers' status – a statistically significant relationship between fathers' and sons' proxy for status. The coefficient estimated from the Becker and Tomes (1986) model, is the intergenerational elasticity (IGE). An $IGE = 0$ indicates perfect mobility which means there was no relationship between a father and son's level of wealth. A $0 < IGE < 1$ indicates imperfect mobility or persistence. The closer to equalling 1, the greater the persistence. Finally, an $IGE > 1$ indicates divergence, since wealthy fathers would give way to wealthier sons.

4.4.2.1 Methods

Becker and Tomes (1986) developed a model that embodies a robust way of examining the transmission of SES between parents and their descendants. Parents – engaging in utility-maximising behaviour – are concerned with the future success and welfare of their offspring. Given parents' SES, they would invest and make consumption decisions for the benefit of their progeny's future prospects. The model is based on a simple Markov model

$$y_{t+1} = a + by_t + \varepsilon_{t+1}, \quad (1)$$

where y_t denotes the wealth variable of the parent, y_{t+1} represents the same variable for the child, and other miscellaneous, stochastic forces that affect the level of wealth of the child is

captured by ε_{t+1} , which is assumed to be independent of the wealth variable of the parent. t is the period of observation of the older generation which would render $t+1$ the observation period for the SES metric of the younger generation.

Following on the work of Solon (1992), and Chadwick and Solon (2002), and given the theoretical overview in the previous section, it is necessary to include age, generation and period controls in the basic model, presented by Equation (1).

The methodological approach involves two steps, as summarised in Table 4-1. Firstly, to eliminate lifecycle bias, this chapter compares the wealth holdings of fathers and offspring at the same age. The methodology involves choosing a group of sons and tracing back their fathers to the same point in their lifecycles. Comparisons, however, now occur across two different periods, when wealth accumulation profiles stabilised at different points during their lives. It is, therefore, necessary to control for period effects, which may present themselves as lifecycle effects (Jenkins, 1987). Secondly, this chapter observes the wealth of the same sons, but compare them to their fathers within the same periods. Lifecycle biases, manifesting themselves as lifecycle increases in the variance of lifetime earnings, undermines mobility estimates. The resulting lifecycle bias is due to fathers being older than their sons at the respective periods. The methodology, therefore, involves controlling for these age effects.

This chapter estimates the IGEs with Ordinary Least Squares (OLS). Jenkins (1987) explicitly shows how OLS may result in biased estimates if lifecycle and period effects are not properly controlled for, which the current estimation strategy aims to do. It is necessary to estimate the models with clustered standard errors, given the presence of more than one observation across time for some of the father-son pairings. Other pairings only have a single observation. Estimating the models by means of clustered standard errors controls for the presence of a particular father-son pairing with more observations across time than another. This is a necessary step to control for repeated information and acknowledge dependence in the data.

After estimating the IGEs for the full sample, this chapter continues to estimate IGEs within narrow age groups with period controls. This additional step serves as a robustness check and illustrates how the IGE varied over the course of the individual lifecycles in the absence of proper controls.

This chapter expects comparable IGEs across all fully controlled models to confirm the hypothesis that lifecycle and period effects result in biased estimates of intergenerational mobility.

Algebraically, the basic models are expressed as:

$$\ln y_{i1,t} = \beta_0 \alpha + \beta_1 \ln y_{i0,t} + T_{ia} + u_{i1,t} \quad (2)$$

$$\ln y_{i1,t} = \beta_0 \alpha + \beta_1 \ln y_{i0,t} + B_{i0} + B_{i1} + u_{i1,t} \quad (3)$$

$$\ln y_{i1,t} = \beta_0 \alpha + \beta_1 \ln y_{i0,t} + B_{i0} + B_{i1} + T_{ia} + u_{i1,t} \quad (4)$$

$$\ln y_{i1,t+k} = \beta_0 \alpha + \beta_1 \ln y_{i0,t} + A_i + u_{i1,t+k} \quad (5)$$

$$\ln y_{i1,t+k} = \beta_0 \alpha + \beta_1 \ln y_{i0,t} + T_{ib0} + T_{ib1} + u_{i1,t+k} \quad (6)$$

$$\ln y_{i1,t+k} = \beta_0 \alpha + \beta_1 \ln y_{i0,t} + A_i + T_{i0} + T_{i1} + u_{i1,t+k} \quad (7)$$

In these models, subscript 1 next to a variable (not coefficient) denotes the son and 0 next to a variable represents the father. Consequently, y_{i1} is the level of wealth of the son for wealth proxy i (one of slaveholdings, cattle, vines or wine). The y_{i0} denotes the wealth of the father, and u_{i1} represents a combination of luck and measurement error on the part of the son for his particular age and wealth proxy that was observed. Year effects, T_{ia}, control for the changes that the 1807 slave legislation amendments would have had on lifecycles. Additionally, T_{ia}, also measures other time-variant shocks that impact the wealth proxies, and of greater significance – lifecycles. Significant changes in government or legislation such as those witnessed at the Cape represent potential wealth shocks. Marquez, Martinez-Canete and Perez-Soba (2013) indicate that in the UK during the financial crisis, households adjusted consumption asymmetrically when subjected to wealth shocks. Two generations should theoretically adjust their own saving and consumption patterns accordingly when subjected to wealth shocks. Lifecycles of these generations would consequently change because of these period effects. B_0 and B_1 represent controls for birth year of father and son respectively, to control for potential age and birth-cohort effects that impact the level of the sons' wealth. The within cross section models, (2) to (4), express the wealth of sons as a function of the wealth of fathers during the same year. Hence t is defined here as the period in which the wealth of the sons and fathers are measured. This estimation strategy eliminates differences in varying macroeconomic contexts, since it does not compare wealth during different periods.

Nevertheless, since the fathers and sons are at different points in their lifecycles, it necessitates the inclusion of additional controls to account for these discrepancies.

Next, the methodology estimates the β_1 IGE coefficients for the father-son pairs, observed at the same age – models (5) through (7). In this context, t again represents the period of observation, however, since fathers and sons are measured in different periods at the same age sons' period of observation needs to be $t + k$, where k is the number of years that needs to be added to sons' year of observation to be measured at the same age as their father. T_{i0} and T_{i1} respectively control for the period in which a settler son and settler father is of a particular age, and A_i controls for the age of the i^{th} father-son pair. This is referred to as within-age estimation given that it compares fathers' and sons' levels of wealth at the same age, which enables elimination of lifecycle effects. Comparing sons and fathers in different macroeconomic contexts, necessitates inclusion of temporal controls.

The next step is to compare the results from these two above-mentioned estimation strategies. If the results yield similar mobility estimates after introducing appropriate controls for period and lifecycle effects, it indicates that two different approaches that control for either period or lifecycle bias, reveal unbiased mobility estimates.

The final step is to estimate the models for subsamples of narrow age groups (with effects). In doing so this chapter explores the likelihood of different age groups exhibiting different levels of mobility. This step comprises estimating models (2), (3), (4) and (6) for the different age group subsamples. Age controls are not included, since observing subsamples of various age groups implicitly controls for these age effects.

To eliminate the effects that 1807 slave legislation changes would have had on the sons' agricultural operations, the sons' mobility is analysed only after 1807. The approach additionally involves measuring fathers' wealth prior to 1807. The study explores if temporal shocks affect mobility estimates, and if controlling for time trends, reduce the biases caused by these shocks.

A priori expectations are that β_1 would be significant and positive. Its size, however, should be smaller than unity, because land size determines agricultural asset ownership. With the growing population and subdivision of land by fathers among their sons, land size would have been decreasing. This chapter, therefore, expects sons in the Stellenbosch district to display convergence toward the mean level of agricultural wealth.

Crucially though, this chapter expects to find weaker persistence when the models are estimated with lifecycle and period controls. The stage of the lifecycle explains this expected weaker persistence, as well as the specific period in which individuals find themselves.

4.5 Results

4.5.1 Descriptive evidence

From Figure 4-2 sons, on average, did not own as many slaves as their fathers. For the 1780 to 1790 birth cohort of sons, the intergenerational gap emerges at age 45 (or around 1825). Later birth cohorts experience a similar gap at earlier ages, all corresponding to a shift in sons' lifecycle around 1825. This shift in the lifecycle in slaveholdings could potentially have resulted from the 1807 slave import ban, albeit with a delayed effect.

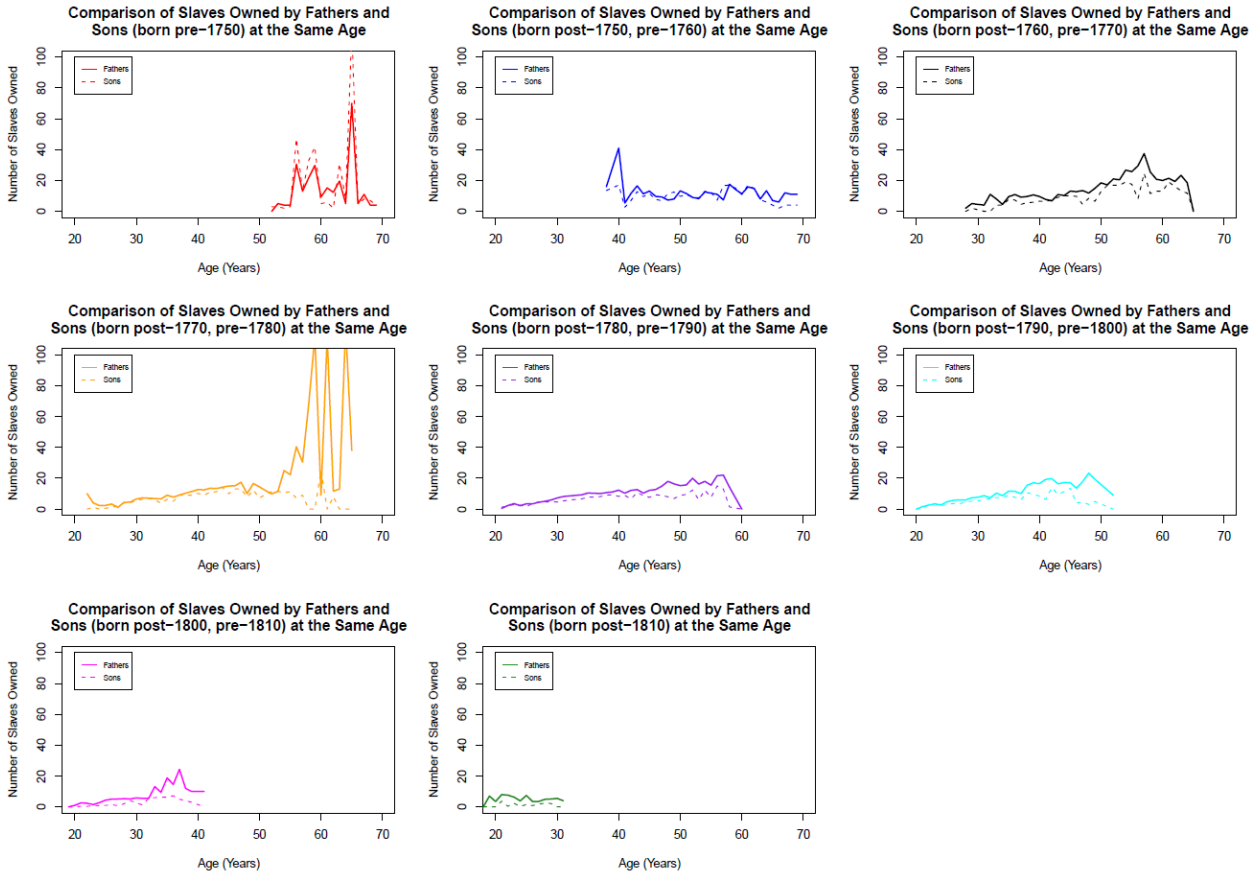

Figure 4-2 Slave ownership comparison of fathers and sons at the same age with son birth cohort being the conditioning factor

During earlier stages of the lifecycle – for all birth cohorts – the average slave ownership of sons was comparable to that of fathers at the same age. For later-birth cohorts though, the divergence in average slave ownership between sons and fathers became more apparent. The changes in the slave legislation may have directly influenced this divergence. Existing slaves

aged out and no new slaves entered the colony. The only additions to the Colony's slaveholdings would be from births. The rate at which sons acquired slaves relative to their fathers would have been markedly slower. Later birth cohorts achieved a peak in their average slave ownership at an earlier age. These descriptive results highlight a number of compelling factors that should be accommodated when estimating intergenerational mobility. Fathers and sons face different macroeconomic circumstances, which change their lifecycle accumulation of wealth. The different period effects and the rates of historical wealth accumulation will cause bias if the dissertation compares father-son levels of wealth within a cross section or at similar ages in different periods.

Figure 4-3 plots the average vines fathers and sons owned. Similar to slaveholdings, there is a positive relationship between the average vines owned by sons and fathers. It is difficult to ascertain any other specific trends or anomalies from the average vine plots. However, peak vine ownership occurred at earlier ages for later son birth cohorts. Following the 1807 Slave Trade Act, slave labour was diverted away from crop farming towards viticulture (Martins, 2019). This would explain this temporal and lifecycle change in vines owned.

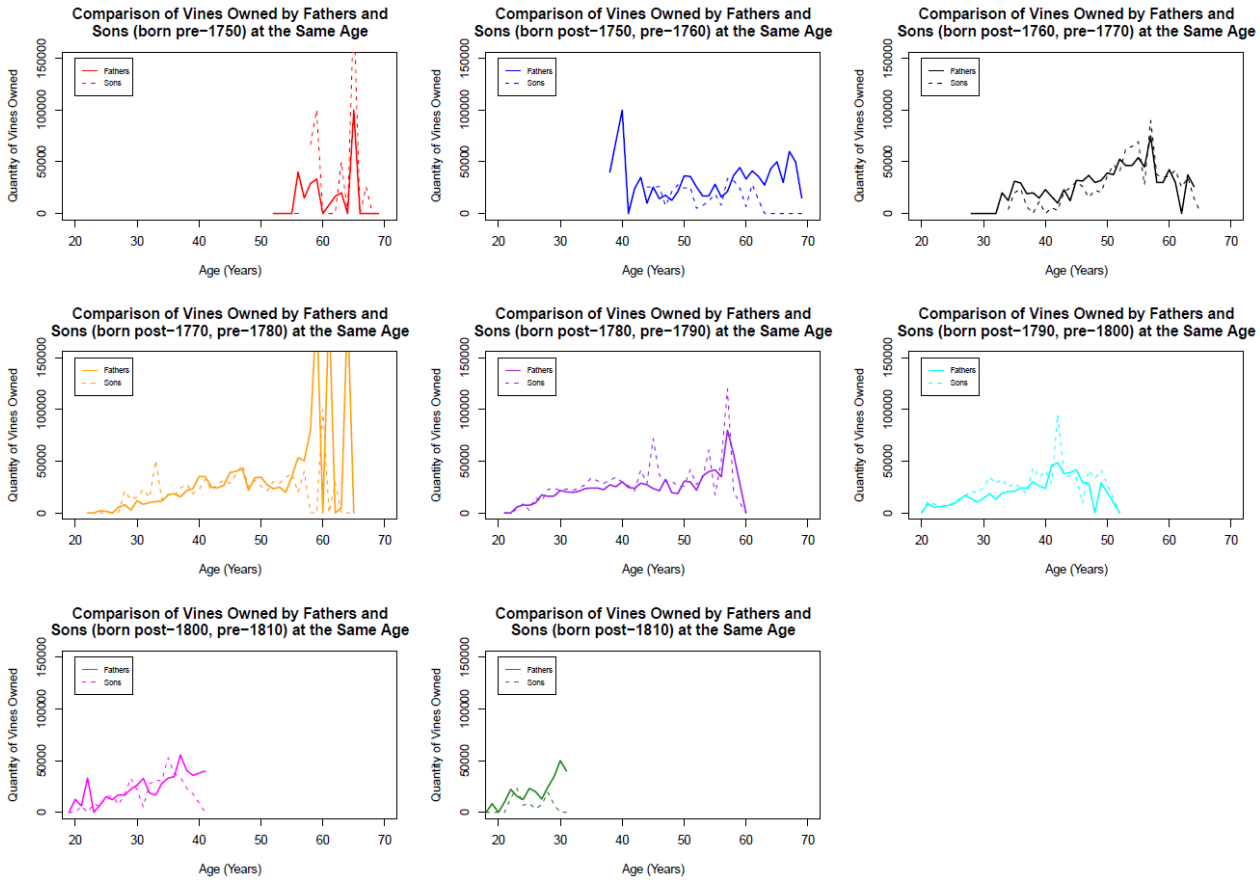

Figure 4-3 Vine ownership comparison of fathers and sons at the same age with son birth cohort being the conditioning factor

Figure 4-4 indicates that there is mostly a positive relationship between the average cattle ownership among fathers and sons. Among later-birth cohorts, however, cattle ownership declines significantly among sons from the mid-1820s until the 1830s mark. As the frontier region of Graaff Reinet with its rocky and mountainous terrain was not as suited for extensive crop or wine farming, livestock farming became the dominant agricultural function. This became especially prevalent in later years, as the frontier region became more established and viticulturists dominated the district of Stellenbosch more.

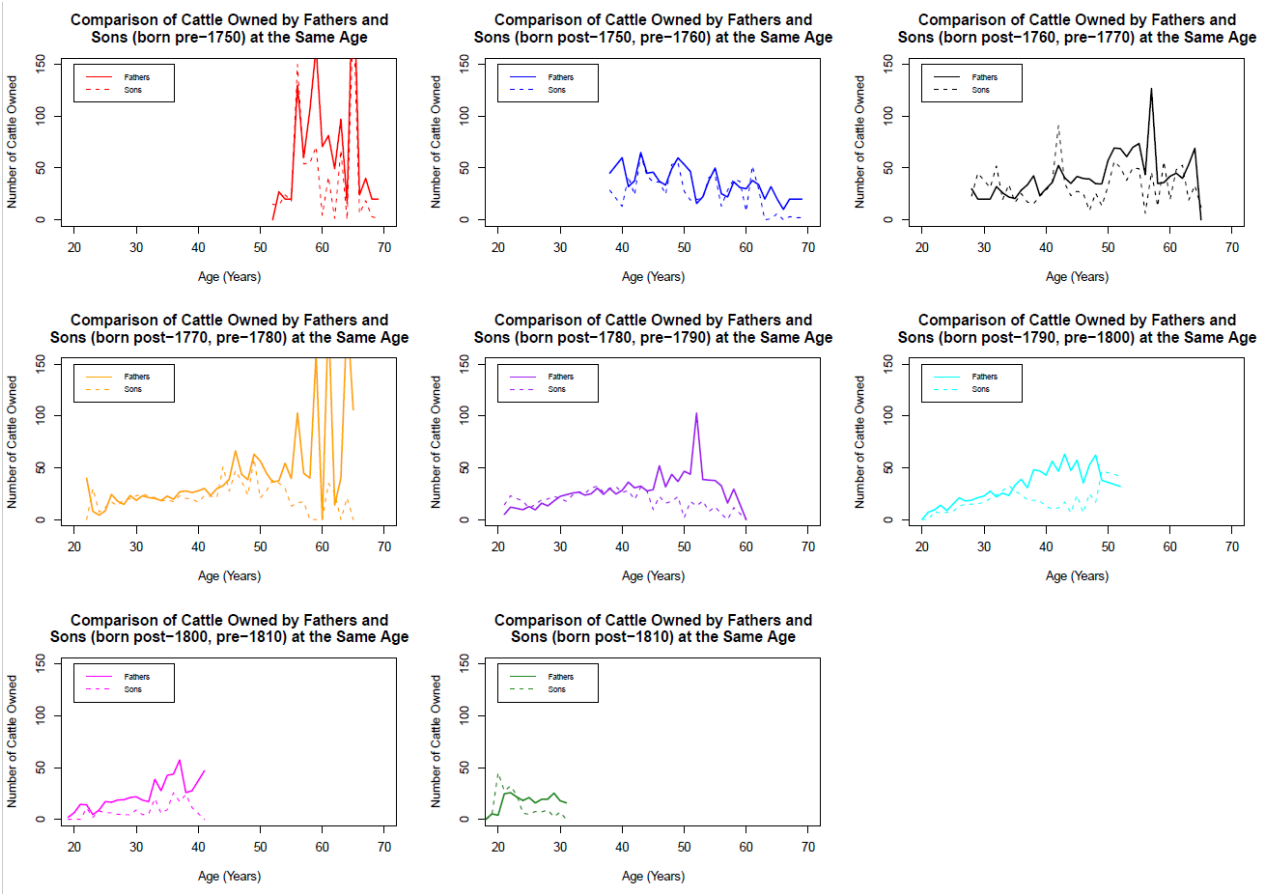

Figure 4-4 Cattle ownership comparison of fathers and sons at the same age with son birth cohort being the conditioning factor

Extensive livestock farmers were moving from Stellenbosch because of their increasing numbers of livestock and the decreasing size of available grazing land. Livestock farmers were not interested in converting their loan-lease land into perpetual quitrent agreements. Loan agreements suited their needs. Livestock farmers were more likely to migrate in search of grazing land. Legislation that negatively affected farmers, would have given households with large livestock holdings a greater incentive to migrate.

The overall conclusion from the plots is that later birth cohorts appeared to reach a peak in their agricultural wealth at an earlier stage in their lifecycle, compared to earlier birth cohorts. Depending on the year in which sons were born, earlier peaks is a preliminary indicator of temporal changes in lifecycles. The change in lifecycle is likely because of the 1807 Slave Trade Act and its consequences. After 1807, younger sons had to reorganise their agricultural approach, compared to the approach followed by their fathers and earlier son-birth cohorts at the same age. The plots are, therefore, illustrations of the period effects presenting themselves as lifecycle changes, noted in Jenkins (1987) and Grawe (2006).

Figure 4-5 compares the median slaveholdings of various birth cohorts across their lifecycles. Figure 4-5 considers median slaveholdings at five-year age intervals instead of average slaveholdings at every age given the erratic movements in Figures 4-2 to 4-4. These erratic movements indicate the presence of significant outliers that may influence average calculations and result in biased calculations – especially if certain ages of specific birth cohorts have very few observations, which happens to be the case. Comparing median slaveholdings with average slaveholdings, serves as a robustness check for outliers. Sons born in earlier years, started out with smaller slaveholdings. They were, however, able to amass slaveholdings at a quicker pace than their younger counterparts at a similar stage in their lifecycle. The 1807 Slave Trade Act explains this difference in the speed of slaveholding growth.

Being the first ones to occupy high quality, fertile land on freehold terms, sons from earlier generations had greater potential to increase their levels of agricultural wealth (Guelke and Shell, 1983). These sons consequently needed more labour inputs to benefit from economies of scale. The governing authority issued grazing permits to the earlier settlers whose livestock grew too big for the plots of land they initially settled.

By 1717 the VOC stopped granting land on freehold terms. For the foreseeable future, land was issued under a loan-lease agreement. Smaller farmers who were not able to acquire sufficient labour to make full use of their land, were replaced. Wealthier farmers who needed large tracts of land to fully benefit from the economies of scale, occupied the land of smaller and unsuccessful farmers. The smallpox epidemic of 1713 nearly wiped out the the Khoi population on which smaller farmers relied for labour. This exacerbated the failure of marginal farmers and the absorption of their land into the estates of surrounding wealthier farmers. The sons born to these established gentry received at least some share of their fathers' productive farming estates under intestacy and under the Roman-Dutch law of inheritance. On the other

hand, with an expanding population and the highest quality agricultural land already being occupied, later-born sons did not have the means or the need to have larger slaveholdings than required. Guelke and Shell (1983) note that the landed gentry at the Cape consisted of individuals characterised by their aggressiveness and upward mobility. They were able to acquire a lot of agricultural wealth within a short time.

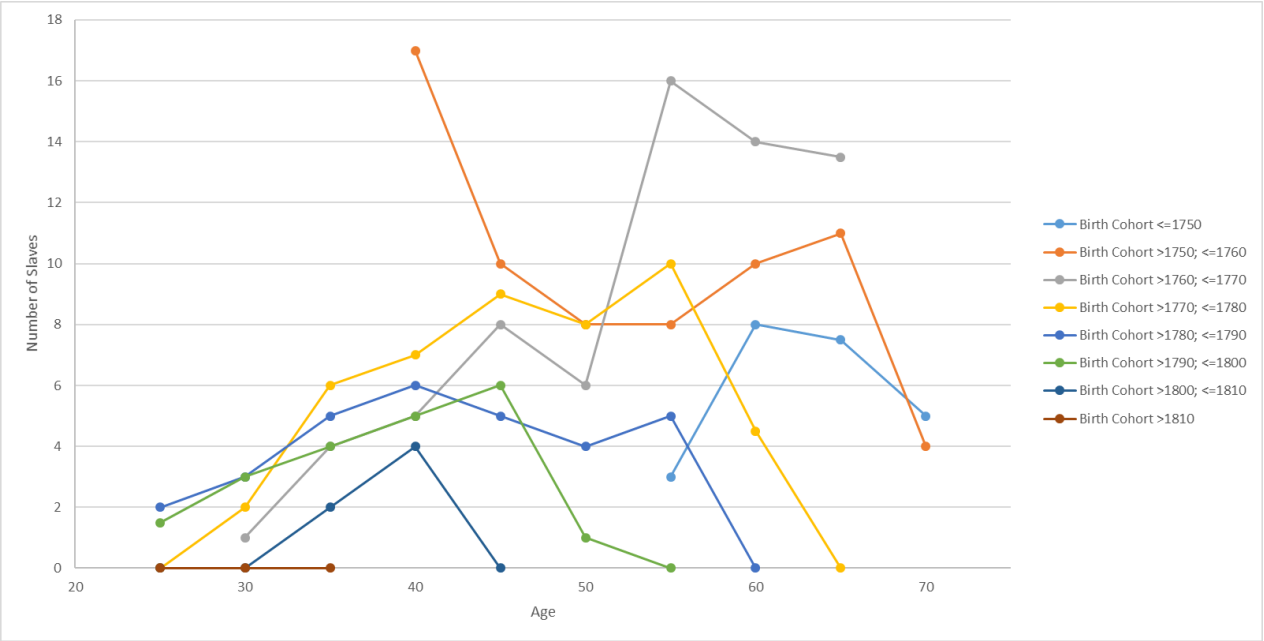

Figure 4-5 Comparison of median slave ownership of various son-birth cohorts at different ages

Starting from a lower base, sons would have been forced from an earlier stage in their adulthood to be more thrifty and industrious to become successful. It is possible, however, that sons in earlier birth cohorts did not inherit as much from their parents. This is what Figure 4-5 suggests. One possibility outlined in Becker and Tomes (1986) is dependent on parents' expectations of the degree of market luck to befall their sons. Aspects such as production possibilities, prices of goods and production inputs determine the market luck of offspring. While parents may not know the exact magnitude of forces that drive their offspring's market luck, in the current pre-industrial, largely agrarian context, nonhuman capital would have been a more significant vehicle of wealth transmittance. Government legislation would have had an impact on the rate of wealth accumulation. For example, the slave legislation of 1807 would have had an obvious impact on the ability of later birth cohorts to acquire slaves later in adulthood. A similar pattern was not detected when analysing the median ownership of cattle and vines. Closer empirical analysis is, therefore, necessary to identify the presence of such lifecycle trends among various birth cohorts.

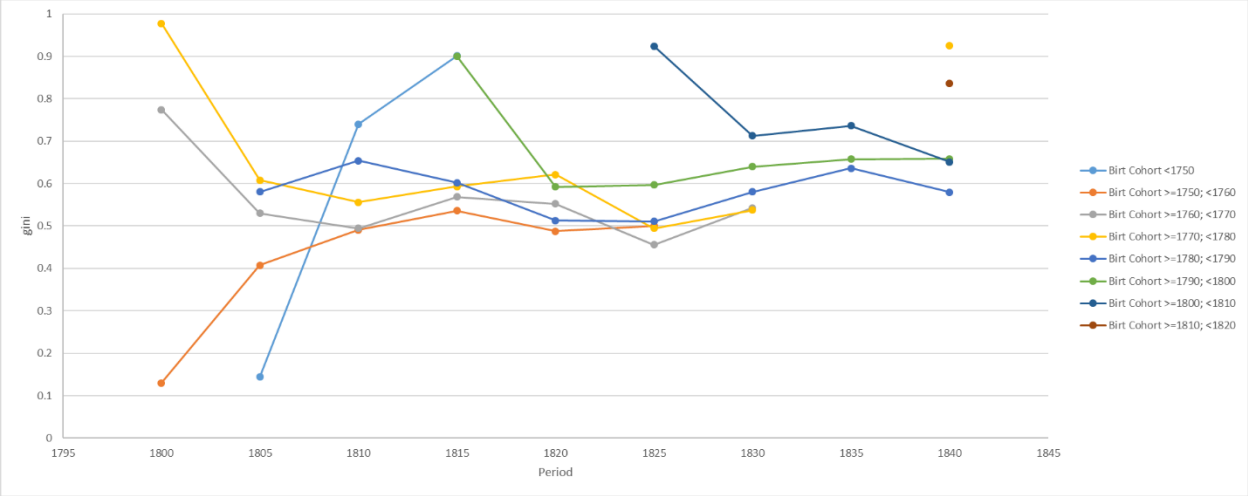

Figure 4-6 Gini coefficient calculated on slaveholdings of sons from various birth cohorts for the expanded sample

Before presenting the findings for the intergenerational elasticities (IGEs), Figure 4-6 illutrates the gini coefficient for inequality of slaveholdings. Consistent with Lillard (1977), the plot suggests differences in the levels of inequality across various stages of the lifecycle. The gini coefficient fluctuates around 0.55. Earlier birth cohorts, however, experience marginally less inequality than later birth cohorts. Sons born later would have inherited slaveholdings from their fathers and would not have been able to acquire slaves from abroad. They relied mainly on their inheritance to determine their level of wealth at the start of adulthood.

From the above plots, the stage in settler sons' lifecycle appears to impact intergenerational mobility. Different birth cohorts exhibit differences in their average and median wealth holdings. It becomes necessary to control for these differences in estimating the intergenerational elasticities (IGEs). Both the stage in the lifecycle, as well as the economic circumstances of a particular period may influence the magnitude of intergenerational wealth transmittance. Failure to control for these factors lead to biased IGE estimates. The following linear regression models introduce controls for lifecycle and temporal macroeconomic differences in wealth. Focus is mainly on slave ownership as an indicator of the overall level of wealth. Slaveholdings were the chief production input in Stellenbosch. It is a robust indicator for the socio-economic status of settler households (Guelke and Shell, 1983; Fourie, 2011; Martins, 2019).

A larger, more inclusive dataset was used to calculate the gini coefficients presented in Figure 4-6. It included all individuals residing in the Stellenbosch district for which links were established with the SAF. In view of this chapter's regression estimates, it is useful to view the gini coefficients calculated on the limited sample as well. The limited dataset only includes

sons in the post-1807 period, for whom links with their fathers could be established in the *opgaafrollen*. Figure 4-7 presents the results.

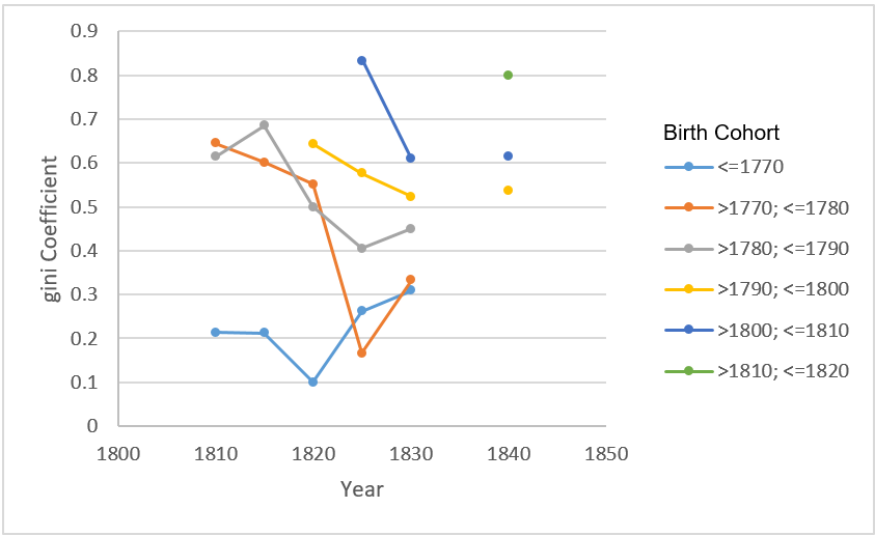

Figure 4-7 Limited sample gini coefficient plots of slave ownership for sons post-1807

The sample size of the limited dataset is substantially smaller (Table 4-5 in Appendix H presents descriptive statistics for this data). Some of the results in Figure 4-7 may, therefore, be less reliable – most notably for the earliest birth cohort. It is possible, however, to draw some general conclusions relating to inequality trends. Inequality was greater among later birth cohorts. Figure 4-7 shows a decreasing trend in inequality among most birth cohorts. With the ratification of the Slave Trade Act, already wealthy sons found it more difficult to acquire even more slaves through importation. With the supply shock to the slave labour market, there was an increase in domestic slave prices (Fourie and Green, 2018b; Martins, 2019). Slaves that passed away would not have been as easily replaced through importation as they had been by previous generations prior to 1807. Later generation settlers, if they sought slave labour, had to rely on the domestic slave market or on inheritance.

4.5.2 Intergenerational elasticity (IGE) estimations

Table 4-2 presents within cross-section (Estimation Strategy (a) from Table 4-1) IGEs for several asset classes. The models presented here include controls to account for period effects through their influence on lifecycles, which affect intergenerational wealth transmittance. Sons' and fathers' asset holdings are observed during the same year. This approach eliminates transitory shocks that changed the demand for, or ability to acquire capital goods. In this chapter's historical context, these capital goods entail slaveholdings (Guelke and Shell, 1983; Fourie, 2011, Martins, 2019). By controlling for the current year and year of birth of fathers

and sons, mobility is estimable without bias and transitory shocks and lifecycle effects do not skew the results.

Before controlling for the period in which historical wealth is measured, all IGE estimates reflected a weak positive relationship between fathers and sons. There was high mobility and weak persistence. The weak results occur because sons are observed earlier in their lifecycles compared to their fathers. Sons did not have the same length of time in which to acquire comparable levels of wealth. High levels of 'mobility' therefore, actually represent a decline in wealth of sons relative to their fathers.

The models in Table 4-2 also introduce year controls to account for period differences among the father-son pairs' years of observation. Fathers and sons were compared at the same point in time, but pairs were recorded in repeated cross sections (refer to Figure 4-1 and Table 4-1 for a detailed explanation). When controlling for period there is no significant change in the size of the slave ownership IGE. There were no transitory shocks that affected the intergenerational slave ownership. The size of the IGE suggests that there was no divergence in terms of slave ownership among sons. In contrast, the significant relationship between the ownership of other agricultural assets broke down as soon as the models introduce period controls. Period dependent factors, through their impact on the lifecycle, were more significant in explaining the ownership of these assets among sons.

Furthermore, the models presented in Table 4-2, control for the birth years of fathers and sons.[72] This is to incorporate cohort and lifecycle differences into the models. The third and fourth columns under each asset class present these results. It is possible that earlier generation fathers could have greater levels of wealth to transmit to their children, given the nature of the more preferable circumstances.[73] Nonetheless, the primary reason this analysis estimate the models

[72] It should be noted that in Table 4-2, the period and birth year controls were included as grouped variables of five year increments. Including the years in levels, resulted in spurious regression results for some of our asset classes. When calculating the clustered standard errors to eliminate repeated information, an error value for the standard errors of both the IGE and constant term was returned for some of our asset classes. For comparison, Table 4-6 in Appendix I presents the models estimated where the year and birth year controls are included in the models in levels (not grouped in increments of five years) with conventional standard errors. When all controls are included in the models in levels, the coefficients are slightly smaller than when included as grouped variables – suggesting that in the latter case mobility is slightly underestimated. However, in the former case, repeated information and non-independent observations might be a problem among some of the wealth proxies. Nevertheless, repeating estimations for slaveholdings, the models with time controls in levels are estimable. Refer to Table 4-8 in Appendix K. When all controls are included, the IGEs are smaller. This implies that estimating IGE without controlling for transitory shocks and generation (proxied by birth year control), mobility may be underestimated.

[73] These circumstances include being owners of freehold land, having a favourable relationship with VOC officials, and having first-arriver privileges as they were the first to settle on the most fertile land.

presented in Table 4-2, is that Figure 4-2 exhibit different lifecycles across generations. It consequently becomes necessary to include controls for birth year that account for these differences across generations. The inclusion of birth years for fathers and sons also accounts for the age differences between the various father-son pairs in the sample. After controlling for birth year, there is a decline in the size of the slave ownership IGE. Concerning the other assets, cattle intergenerational transmittance remains statistically significant after controlling for birth cohort. Wine and vine intergenerational transmittance becomes large and significant after introducing birth years to the model. These assets' coefficients were also similar to those for slaveholdings as wealth proxy. When accounting for year, and year of birth, all assets' IGEs become comparable. Without accounting for generational differences in terms of mobility or potential transitory shocks in the post-1807 sample period, persistence tends to be overestimated.

An important caveat here is that the sample period is not necessarily representative of the actual level of mobility present in the Stellenbosch district, or the Cape Colony at large, for that matter. Hence, estimates – even though unbiased in terms of lifecycle or period effects – is not unbiased in terms of multi-generational families that had enough of an agricultural wealth incentive to persist in Stellenbosch. The sample observed in this chapter consists of father-son combinations that had a big enough incentive to remain in the district of Stellenbosch for two or more generations. For farmers that were not able to make a success it was easy to migrate by applying for loan-lease agreements. This chapter does not reveal the actual situation surrounding wealth dynamics across a highly divergent society of households of various wealth levels. These findings pertain to the effects lifecycles and transitory shocks exert on mobility estimations – particularly in a historical, pre-industrial context where actual wealth data is available.

Table 4-3 presents the IGE for several types of historical asset classes, however, here fathers and sons are measured at the same stage in their respective lifecycles. Table 4-3, therefore, illustrates the IGE estimates by employing Estimation Strategy (b) from Table 4-1. The sample used here was constructed by linking fathers' asset holdings back to earlier stages in their respective lifecycles – even before ratification of the slave import legislation in 1807. Before 1807, economic conditions in terms of accumulating slave holdings from abroad were substantially different. Intuitively, this would have had an effect on agricultural outputs (Martins, 2019). These models are estimated using the same sample used for the within cross-

section mobility models. For all assets, the calculated IGE is significant, albeit small. There was less than a one-to-one relationship between fathers and sons in terms of intergenerational wealth transmittance. In turn, this small relationship is an indicator that there was little to no intergenerational divergence in the sample. Persistence in terms of wealth holdings was present – albeit weak – for all of the historical asset classes. Controlling for the period in which a son and father combination was of a particular age, did not exhibit a significant influence when included in the models alongside controls for age.

Table 4-2 Within cross section intergenerational elasticity (IGE) with period controls and clustered standard errors

Dependent variable: ln(Son Asset Supply, Year x)								
	Slaves				Cattle			
ln(Father Slaves Owned, Year x)	0.34***	0.31***	0.32***	0.33***				
	(0.06)	(0.07)	(0.05)	(0.05)				
ln(Father Cattle Owned, Year x)					0.14**	0.08	0.14**	0.13**
					(0.06)	(0.06)	(0.06)	(0.06)
Constant	0.50***	0.47*	2.14***	1.98***	1.67***	1.87***	3.69***	3.69***
	(0.18)	(0.24)	(0.14)	(0.19)	(0.18)	(0.32)	0.000	(0.22)
Observations	750	750	750	750	750	750	750	750
R2	0.11	0.14	0.32	0.39	0.03	0.10	0.14	0.17
Adjusted R^2	0.11	0.13	0.30	0.37	0.03	0.09	0.11	0.14
Year Controls	No	Yes	No	Yes	No	Yes	No	Yes
Son Birth Year Controls	No	No	Yes	Yes	No	No	Yes	Yes
Father Birth Year Controls	No	No	Yes	Yes	No	No	Yes	Yes
	Wine				Vines			
ln(Father Wine Supply, Year x)	0.17**	0.07*	0.25***	0.13***				
	(0.07)	(0.04)	(0.06)	(0.03)				
ln(Father Vines Owned, Year x)					0.14*	0.14*	0.27***	0.28***
					(0.08)	(0.08)	(0.04)	(0.04)
Constant	1.13***	1.08***	3.43***	2.73***	4.22***	3.28***	9.80**	9.04*
	(0.18)	(0.22)	0.00	(0.13)	(0.71)	(1.19)	(4.61)	(4.64)
Observations	750	750	750	750	750	750	750	750
R2	0.03	0.07	0.24	0.35	0.02	0.03	0.27	0.29
Adjusted R^2	0.03	0.06	0.22	0.33	0.02	0.02	0.22	0.26
Year Controls	No	Yes	No	Yes	No	Yes	No	Yes
Son Birth Year Controls	No	No	Yes	Yes	No	No	Yes	Yes
Father Birth Year Controls	No	No	Yes	Yes	No	No	Yes	Yes

Note: *p<0.1; **p<0.05; ***p<0.01
Clustered Standard Errors in parenthesis

As an example to illustrate interpretation of the estimated IGEs, consider the 0.34 slaveholding IGE in Table 4-2. This statistically significant 0.34 means that if, for instance a father owns 100 more slaves than the average individual in the Stellenbosch district, his child, at the same age, will own 34 more slaves than the average person. It measures how 1% increase in a parent's income or wealth affects the income or wealth of their offspring.

The IGEs from both of the estimation approaches, within cross section and within-age, are similar. This finding suggests that both lifecycles and period effects have significant influence

on the magnitude of the IGE estimates. The fact that the estimates return similar results when following two different estimation approaches for the same sample, serves as an internal robustness check of the size of mobility and effects of lifecycle and period biases.

Table 4-3 Within-age intergenerational elasticity (IGE) estimations for father to son wealth transmittance measured at the same age with controls and clustered standard errors

	Dependent variable: ln(Son Asset Supply, Age x)							
	Slaves				Cattle			
ln(Father Slaves Owned, Age x)	0.37***	0.40***	0.15**	0.17**				
	(0.07)	(0.06)	(0.07)	(0.07)				
ln(Father Cattle Owned, Age x)					0.25***	0.24***	0.17**	0.18**
					(0.07)	(0.07)	(0.07)	(0.08)
Constant	0.73***	0.97***	-0.06	0.05	1.40***	1.30**	-0.31*	-0.69
	(0.14)	(0.37)	(0.15)	(0.45)	(0.19)	(0.55)	(0.18)	(0.74)
Observations	750	750	750	750	750	750	750	750
R2	0.11	0.25	0.28	0.36	0.05	0.21	0.10	0.25
Adjusted R2	0.11	0.18	0.26	0.29	0.05	0.14	0.08	0.16
Son Period of Age Controls	No	Yes	No	Yes	No	Yes	No	Yes
Father Period of Age Controls	No	Yes	No	Yes	No	Yes	No	Yes
Son Age Control	No	No	Yes	Yes	No	No	Yes	Yes
Father Age Control	No	No	Yes	Yes	No	No	Yes	Yes
	Wine				Vines			
ln(Father Wine Supply, Age x)	0.25***	0.23***	0.15**	0.12				
	(0.06)	(0.07)	(0.07)	(0.08)				
ln(Father Vines Owned, Age x)					0.27***	0.26***	0.17**	0.15*
					(0.07)	(0.08)	(0.07)	(0.08)
Constant	1.08***	1.72***	-0.17	0.05	3.66***	5.96***	-0.75	2.89
	(0.16)	(0.53)	(0.13)	(0.75)	(0.55)	(1.80)	(0.56)	(2.40)
Observations	750	750	750	750	662	662	662	662
R2	0.06	0.15	0.14	0.21	0.07	0.13	0.17	0.21
Adjusted R2	0.06	0.07	0.13	0.11	0.07	0.05	0.15	0.12
Son Period of Age Controls	No	Yes	No	Yes	No	Yes	No	Yes
Father Period of Age Controls	No	Yes	No	Yes	No	Yes	No	Yes
Son Age Control	No	No	Yes	Yes	No	No	Yes	Yes
Father Age Control	No	No	Yes	Yes	No	No	Yes	Yes
Note:								*p<0.1; **p<0.05; ***p<0.01 Clustered Standard Errors in parenthesis

Table 4-4 illustrates the IGEs for different age group samples. Estimates for the first two age groups yield similar IGEs – especially when the models include period controls. Moving towards the later stages of the lifecycle, in the absence of controls for lifecycle or period, persistence coefficients increase. This finding is consistent with Haider and Solon (2006) and Nybom and Stuhler (2016) where persistence had a negative relationship with age of the father. Controlling for birth cohort and period differences for fathers and sons, eliminates lifecycle trends from the IGEs. The magnitude of mobility after controlling for period biases in the age group IGE models is nearly identical across the board. In contrast, the coefficients differed

Table 4-4 Within cross-section intergenerational elasticities (IGEs) with period effects and clustered standard errors by father

	Dependent Variable: ln(Son Slaves Owned, Year x)											
Age Group	*>20; <=30*	*>20; <=30*	*>20; <=30*	*>20; <=30*	*>30; <=40*	*>30; <=40*	*>30; <=40*	*>30; <=40*	*>40; <=50*	*>40; <=50[a]*	*>40; <=50*	*>40; <=50[a]*
ln(Father Slaves Owned, Year x)	0.31***	0.31***	0.23***	0.23***	0.35***	0.30***	0.32***	0.29***	0.60***	0.48***	0.53***	0.28**
	(0.05)	(0.06)	(0.06)	(0.06)	(0.10)	(0.11)	(0.09)	(0.09)	(0.10)	(0.08)	(0.12)	(0.11)
Constant	0.16	0.09	-0.17	-0.09	0.73***	0.73**	1.3	1.35	0.73**	1.23**	1.60***	2.09***
	(0.13)	(0.29)	(0.42)	(0.46)	(0.33)	(0.47)	(0.24)	(0.24)	(0.32)	(0.49)	(0.30)	(0.59)
Observations	361	361	361	361	305	305	305	305	57	57	57	57
R2	0.15	0.2	0.20	0.27	0.12	0.21	0.23	0.28	0.3	0.74	0.58	0.90
Adjusted R2	0.15	0.13	0.18	0.20	0.12	0.14	0.20	0.19	0.28	0.55	0.51	0.77
Period Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Son Birth Year Controls	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Father Birth Year Controls	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes

Note: [a]This model has conventional standard errors since too few observations were present in this subsample to calculate clustered standard errors upon inclusion of both birth year and period controls.

*p<0.1; **p<0.05; ***p<0.01

Clustered Standard Errors in parenthesis

substantially among the earliest ages, relative to the latest ages of reporting, when no controls were included in the estimation. This finding confirms the presence of lifecycle biases. Effects of both the stage in the lifecycle at which wealth is measured and period effects that may present themselves as lifecycle effects are present (Jenkins, 1987; Grawe, 2006). These factors exert significant biases on the IGEs and both need appropriate controls. Instead of IGEs for later lifecycle stages that are in the region of 0.48 or greater before the introduction of controls, all age groups' IGEs are closer to 0.25 upon accounting for the biases caused by lifecycles and period of measurement.

4.6 Summary and conclusion

This chapter examined how transitory shocks, lifecycles and birth-cohort effects influence intergenerational mobility estimates. A nearly seventy-year-long longitudinal dataset for the Stellenbosch district of the Cape Colony during the late eighteenth and early nineteenth centuries was employed. The major objective of this chapter was methodological in nature. It is insufficient to estimate a metric for IGE without controlling for lifecycle and period biases since an individual's social status, income or wealth vary over the course of their lifecycle (Favre, 2019). Measuring any of these variables at specific points in time in any study of wealth distribution, inequality or mobility would result in biased estimates (Jenkins, 1987; Grawe, 2006; Nybom and Stuhler, 2016). The variance in lifetime earnings give way to biased estimates of mobility, if the variance in lifetime earnings, as it relates to current earnings, is not controlled (Grawe, 2006). Using current earnings to calculate inequality would lead to biased estimation (Lillard, 1977). This is due to the presence of transitory shocks as well as individuals that are free to make temporal consumption and savings decisions. For example, Haider and Solon (2006) prove the underestimation of persistence when using earlier lifecycle income or wealth metrics, as opposed to indicators later in the lifecycle.

The introduction of the 1807 Slave Trade Act was of major significance in this chapter. It prohibited the importation of slaves into the Cape aboard British vessels. In the slave-based economy of Stellenbosch, this would have significant effects on settlers' agricultural wealth-accumulating abilities. There was an increase in slave prices, given the supply shock (Fourie and Green, 2018b; Martins, 2019). There was a reallocation of slave labour from conventional crop farming to viticulture as farmers tried to hedge against the increased input costs. Naturally, this regime change would have had significant effects on the lifecycle of individuals before and after 1807. Farmers had to adapt their savings, consumption and production decisions,

given the absence of intensive labour-saving farming methods and an overreliance on slave labour in the Cape Colony. Consequently, observing fathers' wealth prior to the Slave Trade Act would have had implications when estimating intergenerational mobility for sons after 1807. Results confirm these biased estimates and proposed appropriate measures to control for them.

This chapter estimated intergenerational elasticities using the model developed by Becker and Tomes (1986) to estimate mobility, and of primary concern, how mobility estimates behave upon the introduction of period and lifecycle controls.

Firstly, this chapter examined the effects of incorporating current year and birth year controls into models of within cross-section mobility. The approach provided information concerning the wealth position of sons relative to their fathers within the same cross section when accounting for lifecycle as well as transitory shocks – such as the 1807 Slave Trade Act. Controlling for the birth year accounts for potential age effects as well as generational differences, brought about mainly by the slave trade regime change. Secondly, this chapter analysed the effect of including age and period of age controls in the intergenerational mobility models. In these models, fathers' and sons' wealth levels were measured at the same age. There are two methods to efficiently control for the lifecycle effects when estimating mobility: 1) cross-section analysis and 2), conducting within-age estimations.

The first major step in the analysis was drawing comparative plots of average agricultural asset ownership in Stellenbosch between fathers and sons. There were positive relationships between fathers' and sons' average levels of asset ownership for various asset classes for all birth cohorts. Slave ownership was the only variable for which a discernible birth cohort effect could be observed. When shifting focus toward slaveholdings and comparing the median slave ownership of various birth cohorts, earlier cohorts were found to start from a lower level of wealth (in terms of slaveholdings), compared to their later-born counterparts. Earlier cohorts, however, acquired greater slaveholdings at a faster rate than their counterparts did. The varying acquisition rates of slaveholdings – as wealth proxy (Guelke and Shell, 1983; Fourie, 2011; Martins, 2019) – serves as a preliminary indicator of potential differences existing among individuals. These differences are a function of stage in the lifecycle, period of observation, and period of age. There was a general decline in inequality among sons in the post-1807 period. This finding is a preliminary confirmation of the Slave Trade Act that showed results

in lifecycle effects. Period biases, presenting themselves as lifecycle effects, are a determinant of biased mobility estimates (Jenkins, 1987; Grawe, 2006).

The major finding was that lifecycle and period biases exerted significant effects on mobility estimations, as is consistent with Jenkins (1987), Böhlmark and Lindquist (2006), Grawe (2006), Haider and Solon (2006), Nybom and Stuhler (2016) and Favre (2019). When accounting for age and period effects, the size of the IGE reduced from approximately 0.40 to lower values of approximately 0.25. In terms of methodological approach, it is necessary for intergenerational mobility research to account for lifecycle effects. Failure in doing this would lead to an underestimation of mobility.

Moreover, conducting analyses on separate subsamples of three different age groups, confirms the main thesis in this chapter. Before including any controls, there are substantial differences in the IGEs of individuals earlier and later in their lifecycles. When including the appropriate period controls in the model for later stage lifecycle IGEs, it becomes almost identical to the IGEs for the early stage of the lifecycle. The within cross section estimates become comparable for period and birth cohort controls. This finding suggests that the birth cohort in which a person was born, exerted a significant influence on an individual's level of wealth accumulation, and it is necessary to control for this, or risk bias in mobility estimates.

This chapter, therefore, contributes to the existing mobility literature in two major ways. Firstly, it shows that when estimating the level of mobility using household level wealth or income data, lifecycle and period effects exert biases on the IGE estimates. Secondly, it proposes a simple and efficient estimation strategy for dealing with these biases. It proceeds as follows: Conduct two sets of estimates, one across ages of fathers and sons and one across period. When estimating these models, introduce lifecycle, period and birth cohort controls to the estimations. Otherwise, lifecycle changes and transitory shocks would result in biased estimates that understate the level of wealth mobility, following a productive asset supply shock.

4.7 Appendix H

Table 4-5 Descriptive statistics for subsamples used in calculation of gini coefficients plotted in Figure 4-7

Number of observations							
Year	1810	1815	1820	1825	1830	1835	1840
Birth Cohort							
>1770; <=1780	15	15	6	2	2		
>1780; <=1790	16	28	30	22	13		
>1790; <=1800			24	43	35		10
>1800; <=1810				6	17		30
>1810; <=1820							17
Maximum slaveholdings in subsample							
Year	1810	1815	1820	1825	1830	1835	1840
Birth Cohort							
>1770; <=1780	24	32	11	12	10		
>1780; <=1790	15	22	30	24	21		
>1790; <=1800			15	29	19		7
>1800; <=1810				1	2		8
>1810; <=1820							10
Minimum slaveholdings in subsample							
Year	1810	1815	1820	1825	1830	1835	1840
Birth Cohort							
<=1770	7	7	8	5	4		
>1770; <=1780	0	0	0	6	2		
>1780; <=1790	0	0	0	0	1		
>1790; <=1800			0	0	0		0
>1800; <=1810				0	0		0
>1810; <=1820							0

4.8 Appendix I

Table 4-6 Within-age intergenerational elasticity (IGE) estimations for father to son wealth transmittance measured at the same age with controls and conventional standard errors

	Dependent variable: ln(Son Asset Supply, Age x)							
	Slaves				Cattle			
ln(Father Slaves Owned, Age x)	0.37***	0.40***	0.14***	0.16***				
	(0.04)	(0.04)	(0.04)	(0.05)				
ln(Father Cattle Owned, Age x)					0.25***	0.24***	0.16***	0.17***
					(0.04)	(0.04)	(0.05)	(0.05)
Constant	0.73***	0.97**	0	0.25	1.40***	1.30**	0	1.67
	(0.08)	(0.39)	(0.89)	(1.08)	(0.12)	(0.65)	(1.60)	(1.90)
Observations	750	750	750	750	750	750	750	750
R2	0.11	0.25	0.333	0.41	0.05	0.21	0.18	0.31
Adjusted R2	0.11	0.18	0.243	0.27	0.05	0.14	0.07	0.14
	Wine				Vines			
ln(Father Wine Supply, Age x)	0.25***	0.23***	0.18***	0.15***				
	(0.04)	(0.04)	(0.04)	(0.05)				
ln(Father Vines Owned, Age x)					0.27***	0.26***	0.19***	0.17***
					(0.04)	(0.04)	(0.04)	(0.05)
Constant	1.08***	1.724***	0	0.75	3.66***	5.96***	0	2.37
	(0.08)	(0.66)	(1.552)	(1.93)	(0.30)	(2.17)	(4.97)	(6.32)
Observations	750	750	750	750	662	662	662	662
R2	0.06	0.15	0.202	0.27	0.07	0.13	0.24	0.29
Adjusted R2	0.06	0.07	0.095	0.08	0.07	0.05	0.13	0.09
Note:								*p<0.1; **p<0.05; ***p<0.01 Conventional Standard Errors

4.9 Appendix J

4.9.1 Within-age IGE estimates for age subsamples

Following the within cross section estimation of IGEs for different age groups, we estimated the IGEs for our father-son combinations at the same age. This would provide us with information concerning the extent of persistence as far as intergenerational mobility is concerned. Moreover, breaking this analysis down by age, would allow us once again to determine if the age at which the IGE is measured, has a significant impact on the size of the perceived intergenerational wealth transmittance. We observe that earlier on in the lifecycle, the IGEs were quite small. Sons' slaveholdings during their early adult years (twenty to thirty years of age) amounted only to approximately a fifth of that owned by their fathers during their own early adult years. Divergence among twenty- to thirty-year-olds was, therefore, not present. This finding remains consistent, even after we introduced period of age controls into the model.

Table 4-7 Within-age intergenerational elasticities (IGEs) with period of age effects and clustered standard errors by father

	Dependent variable: ln(Son Slaves Owned, Age x)					
Age Group	>20; <=30	>20; <=30	>30; <=40	>30; <=40	>40; <=50	>40; <=50[a]
ln(Father Slaves Owned, Age x)	0.18**	0.22***	0.18	0.15	1.21***	1.422***
	0.08	0.08	0.16	0.16	0.34	0.24
Constant	0.71***	0.37	1.339***	1.33	-0.74	-0.64
	0.14	0.45	0.36	0.63	0.86	-0.64
Observations	361	361	305	305	57	57
R2	0.033	0.292	0.024	0.209	0.374	0.973
Adjusted R2	0.03	0.145	0.021	0.011	0.363	0.875
Son Year of Age Control	No	Yes	No	Yes	No	Yes
Father Year of Age Control	No	Yes	No	Yes	No	Yes
Note:						*p<0.1; **p<0.05; ***p<0.01

[a] This model has conventional standard errors as there were too few observations to calculate clustered standard errors.

For thirty- to forty-year-olds the significant IGEs disappear after substituting our conventional standard errors for clustered standard errors. Hence, there is no significant statistical relationship between the wealth standing of sons as proxied by slaveholdings and the wealth standing of their fathers measured at the same age. As we enter the peak stage of sons' lifecycles in the Stellenbosch district, the IGE is statistically significant and greater than one. This suggests that at the similar peak stage in their lifecycle, wealthy fathers gave way to even wealthier sons in terms of slave ownership. Among forty- and fifty-year-olds, it is, therefore, possible to conclude that intergenerational divergence was present among adult settler sons at the peak stage in their lifecycle. Persistence for this age group was prevalent – much more so than for younger settlers. Nevertheless, the sample size is not as large as with our other age

groups – which could potentially cast some degree of suspicion on whether the results are unbiased.

It is, therefore, apparent that substantial differences exist in measuring IGEs at different points in an individual's lifecycle. Age effects exert a significant influence on the size of intergenerational wealth transmittance, and these effects need to be controlled to estimate an accurate IGE. Similarly, the period in which the IGE is estimated, also needs to be considered, as environmental shocks, such as return in output, changes in regulations, export and import tariffs that were amended, and in our particular context, change in the price of produce, are all factors that could contribute toward differences in the measured extent of wealth transference.

4.10 Appendix K

Table 4-8 Intergenerational elasticity (IGE) estimates with slaveholdings as wealth proxy and 'Year Controls' included in levels with clustered standard errors

	Dependent Variable: ln(Son Slaves Owned, Year x)			
ln(Father Slaves Owned, Year x)	0.34***	0.303***	0.22***	0.25***
	(0.06)	(0.07)	(0.07)	(0.06)
Constant	0.50***	0.49*	2.38***	2.22
	(0.18)	(0.27)	(0.17)	(0.22)
Observations	750	750	750	750
Year Controls	No	Yes	No	Yes
Son Birth Year Controls	No	No	Yes	Yes
Father Birth Year Controls	No	No	Yes	Yes
R2	0.111	0.16	0.63	0.70
Note:				*p<0.1; **p<0.05; ***p<0.01 Clustered Standard Errors in parenthesis

Chapter 5

5 Conclusion

5.1 Current state of cliometric research

There is a limited volume of research focusing on African economic history, the most of which exists for Colonial South Africa (Fourie and von Fintel, 2010a; Fourie and von Fintel, 2010b; Fourie, 2011; Fourie and von Fintel, 2011; Fourie, 2013). These studies are consistent in their positions that the Cape Colony was an unequal society, but that the general level of living standards was comparable to the living standards reported in Europe during the same period. The extent of inequality and opportunities for socioeconomic advancement have not received attention, however. Traditionally, economic history research focusing on wealth dynamics exist mainly for historically developed economies (Maas and Van Leeuwen, 2002; Van Bavel, Moreels, Van de Putte and Matthijs, 2011; Knigge, Maas, Van Leeuwen and Mandemakers, 2014; Dribe and Helgertz, 2016). This lack of wealth dynamics research for historically underdeveloped economies is problematic seeing as it prevents research to establish the genesis of pervasive poverty and inequality that generally characterise historically underdeveloped societies.

The literature on social mobility for historically developed economies generally suggest that there is persistence in socioeconomic status (SES) across time and space (Solon, 1992; Björklund and Jäntti, 2000; Jäntti and Jenkins, 2013, Dribe and Helgertz, 2016). This general conclusion suggests that there was a deficiency in opportunities for socioeconomic advancement and that inequality was relatively entrenched and difficult to overcome. The consensus in the literature, in contrast, is that the agricultural frontier is generally more egalitarian and offers greater opportunity for socioeconomic advancement (Sewastynowicz, 1986; Gregson, 1996; Hall and Ruggles, 2004; Stewart, 2005; Stewart, 2009; Di Matteo, 2012).

Traditionally, migrants move toward the frontier when the benefits outweighed the costs of doing so (Joarder and Hasanuzzaman, 2008). The movers were generally those that were poor and landless (Stewart, 2005). Migrants on the frontier would generally have been individuals that failed to be successful in the productive economy of the originating region. Those individuals that stood to gain the most from moving would have been the first to migrate to the frontier (Stewart, 2009). This speaks to first-mover advantages also being at play when studying the links between migration and social mobility. Even though Fourie (2013) reports

that there was substantial geographic movement within the Cape Colony, first-mover advantages need not necessarily only refer to migration. It could also refer to those that entered a particular industry first. Early arriving individuals to any particular region that played host to inhabitants who mainly practices a specific agricultural function would have a knowledge advantage of the climate, soil and market conditions compared to second-movers. This implies that second-movers would need to have additional knowledge or expertise to compete with first-movers. If they were unable to do this, they would have been forced out of the originating economy to ply their trade elsewhere as first-movers. Indeed, Gregson (1996) argues that earlier migrants to enter a frontier and its associated industries reaped greater benefits as the population in the frontier grew. Cilliers and Green (2018) note such advantages relating to the closure of the Cape Colony's agricultural frontier. As the population started to grow and the frontier became saturated with settlers, quality land suited for grazing became in short supply. This would have had an inflationary effect on land values, which, in turn, made it increasingly difficult for second-movers to compete with migrants who arrived at the frontier earlier.

Late-arriving settler households not fortunate enough to have settled on the most fertile and productive land first grew disillusioned with the persistent levels of inequality and inability to catch up with their wealthier counterparts. The frontier offered refuge to these households. Characterised by low entry requirements and vast tracts of land made the frontier a more egalitarian society. The livestock farming practiced there for which slave labour and high start-up capital was not required appealed to the failing or late-arriving settler households of the older, extensive wine-farming Stellenbosch district. Settlers, who had sufficient means in terms of agricultural wealth to weather negative market shocks and high competition in the regions of the colony practicing extensive farming, persisted. Deficient agricultural wealth and lack of opportunity served as sufficient incentive to search for greener pastures on the frontier. Inequality, agricultural wealth and lack of opportunity for its accumulation was the major determinant of migration from the more established regions of the pre-industrial, historically underdeveloped society of the Cape Colony.

In examining a frontier economy in a modern developing context, Murphy, Bilsborrow and Pichon (1997) emphasise the divergent outcomes of migrants on the Ecuadorian Amazonian frontier. Some households on the frontier are often found to be better off than others. Wealthier families tended to be larger, own more land and have access to land that is more fertile. Apart from varying outcomes on the frontier, which could be explained through first-mover advantages, migrants also move to the frontier for varying reasons (Flavio, Carr and

Bilsborrow, 2009). Personal characteristics, human capital, lifecycles, networks and access to resources and infrastructure are all potential determinants.

African cliometric research has historically not received much attention. Research concerning wealth dynamics, the evolution of inequality and migration have especially been subject of deficient research focus. Existing research is mainly concerned with wealth dynamics of historically developed countries. Little focus has been afforded to historically underdeveloped societies in a pre-industrial context. The major cause for this deficiency is attributed to the lack of individual-level, longitudinal data of quality. Fortunately, for South Africa, and the Cape Colony in particular, research has witnessed an upswing in recent years. This dissertation is primarily a practical illustration of the benefits to have access to quality data when examining chronic issues, such as skewed wealth distributions and pervasive inequality in a pre-industrial setting for a historically underdeveloped society. It permits novel statistical strategies that have not been possible until now, particularly when analysing mobility and migration. The technical significance of this dissertation notwithstanding, the results returned are of practical importance as well. It provides a historical context for the current high levels of inequality plaguing South Africa.

This dissertation employed a longitudinal dataset of nearly seventy years to study questions relating to wealth dynamics, mobility and migration. The data is an expanded version of the tax records for settlers of the Cape Colony, originally transcribed in selected years by Dr Hans Heese of Stellenbosch University (*opgaafrollen*) (Fourie and Green, 2018). The dataset contains household-level details on various agricultural assets and outputs, such as livestock, vines, wine supplies, crops and slaveholdings. It also spans decades. The *opgaafrollen* are, therefore, unique in terms of the combination of its geographic coverage, detail enclosed, and length of observation. Similarly, Favre (2019) analyses social mobility bias for a digitised version of the directory of citizens for Zurich that contains microlevel data for the city's male citizenry. The *opgaafrollen* is the only dataset of its kind that exists for a historically underdeveloped society for a long-term pre-industrial period for different locations with divergent geographic and economic characteristics. In the largely agrarian society of the Cape Colony, the dataset is, therefore, appropriate in analysing the distribution of agricultural wealth, wealth mobility, and the consequences of persistent inequality. The focus is on European settlers during the late eighteenth and early nineteenth centuries.

The results presented here paint the Cape Colony as an unequal society – at least as far as agricultural wealth was concerned. This inequality was more prevalent in the more established regions of the Colony, like the district of Stellenbosch, for instance. From an early period in the Cape's development, the extensive farming practiced in Stellenbosch's winemaking intensive, slave-labour heavy economy translated into high levels of agricultural wealth inequality. Slave labour allowed economies of scale, meaning larger farming ventures more adept at weathering negative market shocks and operating more profitable farming ventures than their small-scale counterparts.

5.2 Chapter summaries

In Chapter 2, two major districts of the Cape Colony were compared in terms of their wealth mobility and inequality. The two districts, Stellenbosch and Graaff Reinet, were dissimilar in terms of their geography, length of existence and major economic operations. The major findings in this chapter suggest that the levels of agricultural wealth inequality in the two districts were very different. Stellenbosch was substantially more unequal than Graaff Reinet. The frontier district of Graaff Reinet was far more equal in terms of agricultural wealth, which is consistent with historical accounts of Neumark (1957) and literature such as Di Matteo (2012). This equality at the frontier, however, decreased with time – especially after the closure of the frontier. In contrast to what Neumark (1957) suggested, agricultural wealth mobility of settlers in Graaff Reinet was not significantly greater than in Stellenbosch. The opportunities in the two districts for socio-economic advancement were not markedly different, which is more consistent with Guelke's (1976) theory of Graaff Reinet absorbing failed agriculturists who had no other economic options. Although poorer households in Graaff Reinet were able to become wealthier relative to their peers in earlier years, this dissipated in later years. This finding substantiates the results of Gregson (1996) suggesting greater advantage for first-moving frontier migrants. The closure of the agricultural frontier was put forward as the cause for the dissipation in relative socio-economic advancement as land values appreciated and more knowledge and capital became necessary for competiveness.

It is well established that residents of the Cape Colony were the subjects of frequent and vast migration patterns (Neumark, 1957; Guelke, 1976; Fourie, 2013, Cilliers and Green, 2018). Settlers migrated often and in considerable numbers. Chapter 2 consequently also examined potential reasons for this geographic dynamism. Data limitations did not permit analysing inter-district migration of the same settler family. Therefore, the major focus in this chapter was on

out-migration and wealth mobility's potential role in driving it. The approach in this chapter stands in contrast to the strategy followed by Cilliers and Green (2018), in their analysis of the in-migration at the Cape Colony agricultural frontier. The reason why settlers left a particular district in the first place has not yet been explored.

Conventionally, in modern research, migration takes place because of positive selection. This occurs when high-skilled individuals migrate to locations where they stand to realise greater returns on their human capital relative to the sending region (Borjas, Bronars and Trejo, 1992). Negative selection, in contrast, may also occur in the event of an oversupply of low-skilled workers in the sending region. This generally takes places in circumstances characterised by low population densities and open borders that permit the free flow of low or unskilled workers. Abramitzky, Boustan and Eriksson (2012) return evidence for such negative selection in the case of Norwegian migrants from urban regions to the United States during the age of mass migration. Norwegian migrants with poor economic prospects in Norway's urban areas were more likely to migrate to the United States in search of greater economic opportunities. The open borders, low population density and low entry costs of the agricultural frontier of the Cape Colony created the ideal circumstances for negative selection to occur. Indeed, Hatton and Williamson (2006) note that negative selection takes place more frequently where migration costs are low. Additionally, Borjas (1987) argued that negative selection is more likely if the income distribution in the sending region is more unequal. The Cape Colony therefore presented all of the qualities argued to be necessary for negative selection to take place.

Survival models were used to establish the determinants of out-migration from each district. These models suggested that household size was the major determinant of settlers persisting in Graaff Reinet. In Chapter 2, hazard rates were then estimated from these survival models and they were subsequently included in the micro-convergence models. This statistical approach permitted establishing if lack of economic opportunities for agricultural wealth advancement, was a driver of out-migration. In Stellenbosch such an effect was confirmed. The substantial agricultural wealth inequality, the relatively low levels of mobility, and lack of opportunities for convergence, gave way to out-migration from Stellenbosch. In comparison, the results for Graaff Reinet were marginally different. Only after 1812, which marked the year in which the agricultural frontier closed (Giliomee, 1982), was a consistent and statistically significant relationship between wealth convergence and out-migration identified. Prior to 1812, there was no such relationship between likelihood of out-migration and wealth mobility. Low-skilled, low-capital settler households negatively selected themselves from the district of Graaff Reinet

with the decrease in economic opportunity. The closed frontier resulted in decreasing land availability as the population continued to grow (Cilliers and Green, 2018). Livestock farmers who were not able to remain competitive in this changing environment, exited the district.

These results, therefore, stand in contrast to what Neumark (1957) suggested. There were no abnormally high returns for settlers at the frontier. If this had been the case, there would have been an influx of settlers from the established districts despite the convergence there, not because of its absence. Less wealthy households migrated in the absence of agricultural wealth convergence. Consistent with Guelke (1976), settlers migrated from districts when there were no other options and when they failed to improve their economic circumstances relative to their peers. High inequality at the Cape (Fourie and von Fintel, 2011) and the inability to escape it as indicated in this chapter, therefore, contributed towards settlers' migratory decisions.

Chapter 2 found that the lack of individual wealth mobility predicated out-migration from the districts of Stellenbosch and Graaff Reinet. It was necessary, however, to pose the question, whether this relationship was uniform among various settlers with diverse personalities. Subfields within the psychology literature, such as evolutionary psychology, child development, psychoanalytic perspectives and personology, suggest that in contemporary contexts, the order in which a child is born moulds their personality (Adler, 1927; Adler, 1928; Sulloway, 1996). These personality differences give way to divergent adult socio-economic outcomes (Taubman and Behrman, 1986; Majoribanks, 1989; Draper and Hames, 1999; Milne and Judge, 2009; Sulloway, 2010). Focus in Chapter 3 was shifted towards out-migration from the Stellenbosch district specifically, and towards whether birth order was a significant determinant thereof. Of particular importance was testing two alternative hypotheses. This chapter established whether birth-order-induced personality and loyalty effects or agricultural wealth effects, resulted in out-migration from Stellenbosch.

Chapter 3 seeks to dismiss siblingship-induced personality differences as a significant determinant of out-migration from Stellenbosch in favour of the level of agricultural wealth as a determinant of persistence. The chapter relied on selected psychology and sociology frameworks to inform estimates of the potential effect that birth order may have on personally and, in turn, adult socioeconomic outcomes. Moreover, loyalty effects engendered through potential preferential parental treatment are analysed through the inclusion of name inheritance in the estimates of Chapter 3. Great importance is attached to naming offspring – especially in earlier periods. In deciding what to name their children, parents considered several factors

(Lieberson and Bell, 1992). Among these factors are parents' need for longevity and carrying forward the patrilineal descent (Rossi, 1965). The chapter challenges popular psychology theories and models such as the Family-Niche Model of Sulloway (1996) and Sibling Rivalry theory of Adler (1927, 1928) in driving psychological differences among siblings that give way to divergent socioeconomic outcomes. These theories suggest that birth order result in siblings, as a means of competing with each other for limited parental resources and care, occupying different familial niches and consequently developing divergent personalities significant enough to influence decisions and socioeconomic outcomes.

The estimation strategy involved complementary log-log survival models. In these models the major variables of concern were birth order and name inheritance. Estimation results from an expanded sample suggested that birth order was significant in explaining persistence in Stellenbosch. Earlier-born settlers were more likely to persist in the district for longer. Name inheritance, in contrast, was consistently insignificant in explaining persistence across various model permutations. Loyalty effects among parents and offspring, engendered through naming offspring after elder kin, were insignificant in explaining out-migration decisions from Stellenbosch. Consequently, it was necessary to establish the cause for birth-order significance in migratory decisions. The relationship between birth order, name inheritance and wealth holdings was consequently investigated. A statistically significant relationship between birth order and wealth holdings was found. This suggests that the earlier settlers were born, the more likely they were to have inherited more wealth from their parents. A significant negative relationship was returned for name inheritance and agricultural wealth. Loyalty effects engendered through preferential parental treatment because of name inheritance were, therefore, not at play in offspring wealth inheritance. Instead, the strong relationship between birth order and name inheritance resulted in name inheritance manifesting itself as an additional birth order effect in the agricultural wealth model. Personality differences was therefore unlikely in driving out-migration from Stellenbosch. Instead, agricultural wealth was the major determinant. With older siblings being better endowed with agricultural wealth than their younger counterparts they were more likely to persist for longer.

When analysing intergenerational wealth transmittance, a significant and persistent issue has been to properly account for lifecycle and period effects. These factors have the potential of yielding biased mobility estimates if not controlled for properly. Conventional intergenerational wealth mobility research works with census data that are usually decades apart. These types of datasets only provide snapshots of the wealth position of the fathers and

sons. Attempts to control for lifecycle biases are usually reduced to including age controls in intergenerational wealth mobility estimates. This is not a sufficient empirical approach to correct for lifecycle biases. The different macroeconomic contexts, in which various generations find themselves, subject intergenerational mobility estimates to period biases. These period biases may present themselves as lifecycle effects when estimating intergenerational mobility. Reneging on including controls for period effects would result in biased estimates of intergenerational wealth transmittance.

Chapter 4 proposes an alternative strategy to model intergenerational wealth mobility by controlling for both period and lifecycle effects. Not controlling for these effects would result in biased estimates of intergenerational mobility (Jenkins, 1987; Grawe, 2006; Haider and Solon, 2006; Nybom and Stuhler, 2006). The estimation strategy is two-pronged. The first leg of the approach involves measuring fathers' and sons' wealth during the same period. In these sets of estimations, focus was on the period after the slave legislation changes in 1807. This approach innately controlled for period biases since fathers' and sons' wealth were measured in the same period. It becomes necessary to account for lifecycle biases produced when measuring the wealth of the two generations at different ages. Birth years of each generation in each father-son pairing were consequently included in the estimations. The model included father-son pairings that were observed in different years, however. To account for this, controls for current year were included in the model. The second leg of the estimation strategy involved measuring fathers and sons at the same age. Different macroeconomic contexts became problematic, since they opened the door to period biases that predisposed intergenerational mobility calculations to inaccurate estimations. It, therefore, became necessary to include age and period of age controls.

Slaveholdings were the central focus of mobility estimations, given its status as a relatively robust indicator of overall agricultural wealth. The long-run longitudinal dataset – spanning nearly seven decades, allowed for this type of analysis where the wealth of fathers and sons could be measured at the same age and in the same period. Results for the two sets of estimations showed that period and lifecycle biases were both significant in yielding biased mobility estimates. When all of the controls were included, mobility was underestimated in the absence of the controls. The size of the estimated mobility was comparable for both sets of models. Since the sample is limited to father-son pairings that were present in both the within cross section models and within-age models, it is possible to evaluate this estimation strategy as being efficient in dealing with lifecycle and period biases. Reneging on controlling for these

effects would result in biased mobility estimates and lead to erroneous conclusions about the extent of a society's socioeconomic opportunities.

5.3 Significance of dissertation and proposed future research

The objective of this dissertation was to apply advanced statistical and analytical approaches to a unique, individual-level longitudinal dataset for a historically underdeveloped, pre-industrial society. Novel statistical approaches were applied to a centuries-old dataset in an effort to obtain an understanding of the nature of wealth dynamics, inequality, and migration in the Cape Colony. The aim was to contribute to the burgeoning interest and academic curiosity in African, and particularly in Southern African historiography.

The results of this dissertation have significant implications, for understanding pre-industrial economies of a historically underdeveloped society, and for methods relating to utilising historical wealth or income data. In a pre-industrial society where fertile land was abundant, extensive farming was practiced and inequality prevailed in more established regions, individuals migrated because economic opportunities were limited. This effect would have been particularly prevalent if productive activities in the migration destination offered relatively simple and cheap entry costs. With a history of strict price controls on production outputs and limited markets, a society focused on arable farming where land was the most important factor of production, primitive and extensive farming techniques would have led to entrenched inequality.

The effects of price controls and limited markets would have persisted for some time – even after the introduction of more liberal economic policies. In their desperation to escape this entrenched inequality, unsuccessful farmers in more established arable farming regions of a primitive farming society would have been lured by the appeal of the cheap entry costs of other industries in regions further removed from these more established areas. For migrants in the Cape Colony, the perceived benefits of migrating out of the established districts outweighed the costs of doing so. Agricultural wealth holdings and the opportunities for accumulating this wealth play a substantial role in explaining out-migration within a primitive farming society.

Modern psychology theories concerning the effect of birth order and adult economic outcomes, although having some precedence in modern societies do not hold consistent in a pre-industrial setting as far as migratory decisions are concerned. This dissertation rules out personality differences induced by birth as a determinant of out-migration. In a time where geographic mobility was frequent and arguably among the major economic outcomes, agricultural wealth

was the predominant determinant of migration. Birth order may explain migration, but this is through the vehicle of agricultural wealth. Earlier born sons are more likely, through inheritance, to own more agricultural wealth. This serves as incentive to persist geographically as opposed to personality driving migratory decisions.

This dissertation consequently also contributed to the understanding of first-mover advantages that is not necessarily restricted to geographic movements, but also entrance into a particular industry in the context of a pre-industrial, historically underdeveloped society. Settlers that entered a particular industry first were able to acquire knowledge and expertise of that industry's market conditions, which placed them at an advantage over second-movers. Similarly, in the agrarian Cape Colony, first arriving settlers that occupied a particular region that specialises in a specific industry amassed knowledge of the soil, climate and market conditions in that region. Second-movers would consequently have needed additional skills and expertise to compete with first-movers or exit the particular industry or district if they were unable to converge on their first-moving counterparts. Likewise, earlier born brothers would have been the first-movers into a particular industry granting them more time to grow familiar with market conditions and the family agricultural operation. This knowledge would have placed them at an advantage over their later born siblings and would have made them the preferred choice for greater inheritance and ultimately assuming control of their parents' agricultural operations upon their death or retirement.

The importance of agricultural wealth in determining migration in a primitive farming society has significant implication in terms of empirical methodology. When using historical, longitudinal wealth data to analyse household welfare, it is necessary to take lifecycle effects as well as varying macroeconomic contexts into consideration. Analysing wealth or income data across time, especially over the long-run, bears with it implicit changes in macroeconomic contexts and lifecycle effects that needs to accounted for. Reneging on controlling lifecycle and period differences in analyses observing the wealth or income of individuals of various ages across time would result in biased empirical estimates.

Chapters 2 and 3 considered out-migration and its determinants. Future research, once the full Colony longitudinal dataset is available, will be able to determine the determinants for migration toward particular districts alongside the success of migrants in their new locations. In the study at hand, a demographic dataset (SAF) with genealogical data was linked to the historical tax censuses, which allowed for fresh approaches to long-standing, little-explored

questions. Among these issues were whether birth order or name inheritance affected migration and agricultural wealth. Linking the same dataset to the expanded dataset – once completely transcribed – would permit future research to properly establish migratory patterns of siblings born in different orders. Analysing name inheritance in the Cape is also not yet exhausted. Upon the availability of the fully digitised version of the *opgaafrollen*, it would allow sufficient data points of grandsons linked to grandfathers to analyse the influence of outcomes like wealth accumulation and migration among settlers that inherited their grandfathers' names. The clear pattern of earlier-born sons inheriting their fathers' names in the Cape, potentially opens the door to further sociology, psychology and onomastics research, and it justifies further examination.[74] Official tax records for Stellenbosch in particular at the Cape Archives, span nearly 150 years. In light of wealth mobility forming a major part of Chapters 2 and 4, the very long period of this data would allow for multigenerational wealth mobility estimations, using slaveholdings or vines as wealth indicator.

This dissertation provides a useful platform to future researchers and scholars to further explore wealth mobility and migration in the Cape Colony. The themes and questions explored here should be regarded as a primer and is not exhaustive. There is still much to understand about the mobility and migration in the Cape Colony. Such understanding would lay the groundwork for comparative analyses of other colonial societies, to establish common threads in migration and wealth accumulation patterns. Whether the divergence in long-term developmental trajectories was a result of geography, institutions, regulatory frameworks, or cultural differences, could be established. Comparing the characteristics of wealth dynamics and factors driving migration in different colonial societies – particularly on the African continent – would provide insight into the historical determinants of prevailing levels of wealth inequality, geographic dispersion, and mobility.

[74] This is the research of the history and origin of proper names which include place names, surnames, first names and in this particular case, personal name transmission.

6 Reference list

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